

SYNOPSIS OF AUSTRALIAN PIPEFISHES USUALLY REFERRED TO THE
SYNGNATHINE (TAIL-POUCH) GENERA *SYNGNATHUS*, *LEPTONOTUS*
AND *HISTIOGAMPHELUS*

BY C. E. DAWSON

Gulf Coast Research Laboratory Museum, Ocean Springs, MS 39564 U.S.A.

Abstract

Twelve Australian species, usually referred to the syngnathine genera *Syngnathus* and *Leptonotus*, are referred to five genera (*Parasyngnathus*, *Vanacampus*, *Pugnaso*, *Kaupus*, *Mitotichthys*), and two species are recognized in the genus *Histiogamphelus*. Representatives of *Leptonotus* and *Syngnathus* are presently unknown from Australia. Treated taxa share the same configuration of principal body ridges (discontinuous lateral trunk and tail ridges, confluent inferior trunk and tail ridges), but differ in the morphology of the brood pouch, in the development of certain ridges on the head and in other features. *Parasyngnathus* Duncker (with opercular ridge, pouch plates, everted pouch closure) includes the type-species, *P. penicillus* (Cantor), a senior synonym of *P. argyrostictus* (Kaup), and *P. parvicarinatus* (Dawson). *Vanacampus* Whitley (with opercular ridge and semi pouch closure, without pouch plates) includes the type-species, *V. vercoi* (Waite and Hale), and three congeners, *V. margaritifera* (Peters), *V. phillipi* (Lucas) and *V. poecilolaemus* (Peters). The monotypic *Pugnaso* Whitley [type-species: *P. curtirostris* (Castelnau)] lacks the opercular ridge and pouch plates and has the semi pouch closure. *Kaupus* Whitley, also monotypic [type-species: *K. costatus* (Waite and Hale)], has an opercular ridge, pouch plates, everted pouch closure and a trunk that is exceptionally deep in adult females. *Mitotichthys* Whitley (without opercular ridge, with elevated dorsal-fin base, with or without vestigial pouch plates, with everted pouch closure) includes the type-species, *M. tuckeri* (Scott), and *M. semistriatus* (Kaup), as well as two poorly known species, *M. meraculus* (Whitley) and *M. mollisoni* (Scott), that are included provisionally. *Histiogamphelus* McCulloch (with elevated snout ridge and dorsal-fin base, without opercular ridge, with or without vestigial pouch plates, with everted pouch closure) includes the type-species, *H. briggsii* McCulloch, and *H. cristatus* (Macleay). *Parasyngnathus penicillus* (Arabian Gulf to Japan) and the endemic Australian *P. parvicarinatus* are mainly restricted to the northern half of the Australian mainland. The remaining taxa are restricted to Tasmania and the southern half of the Australian mainland. Complete synonymies, diagnoses, keys to genera and species, and data on variation and distribution are provided; all species, except *Mitotichthys mollisoni*, are illustrated.

Gilbert Whitley, in several reports published during the years 1940-51, proposed a number of new genera, subgenera, and other nomenclatural changes for some Australian pipefishes historically referred to the syngnathine (tail-pouch) genera *Syngnathus* Linnaeus and *Leptonotus* Kaup. Some of these changes were incorrect, his new genera and subgenera were not diagnosed adequately, and Whitley's proposals have been overlooked or ignored by most subsequent workers. As a result, the most recent general treatment of Australian pipefishes (Munro, 1958) refers 16 nominal species to the genus *Syngnathus* and 3 to *Leptonotus*. Among those included in *Syngnathus*, four names (*S. parviceps*, *S. wardi*, *S. conspicillatus*, *S. sauvagei*) have since been placed in synonymy (Dawson, 1977, 1978a, 1978b), *S. pelagicus* Linnaeus is unknown from Australia, and *S. superciliaris* Günther is a junior synonym of *Filicampus tigris* (Castelnau). Dawson (1978b) also synonymized *Leptonotus*

caretta with *Syngnathus curtirostris* Castelnau, and described *S. parvicarinatus* as a new species from Australia. I here treat the 11 nominal Australian species currently referred to *Syngnathus*, as well as the remaining species and subspecies referred to *Leptonotus* and *Histiogamphelus* McCulloch by Munro (1958). All but one of these are endemic to Australia, all have the same configuration of principal body ridges, and none are referable to either *Leptonotus* or *Syngnathus* sensu stricto.

This synopsis, based on the majority of known specimens, resurrects several of Whitley's genus or subgenus names for the accommodation of species incorrectly referred to *Syngnathus* and *Leptonotus*. Relationships of these Australian species groups are, in part, uncertain, and some (e.g. *Pugnaso* and *Vanacampus*) may eventually prove to be congeneric. Similarly, the generic placement of some species, presently known only from the original description or a few poorly preserved

specimens, is provisional. Nevertheless, this report summarizes pertinent information on treated taxa, resolves a number of nomenclatural and taxonomic problems, and should provide a useful foundation for future studies.

Generic Characters

Although treated Australian genera are distinguished in the key and diagnoses, remarks on some characters distinguishing *Leptonotus* and *Syngnathus* from these taxa are appropriate here.

Pouch closure: Herald (1959) showed that the lateral membranous folds enclosing the eggs of brooding males of syngnathine genera exhibit different types of closure along the ventral midline of the brood pouch. In *Syngnathus*, the pouch closure is the inverted type (Fig. 1), wherein the lateral folds meet on the midline and extend dorsad within the egg-filled pouch. In *Leptonotus*, and four of the genera treated here, pouch closure is the everted type, wherein the membranous folds overlap and fold outward on the ventral surface of the pouch. The two remaining Australian genera have the semi type of closure, wherein the folds merely meet or nearly meet on the midline of the egg-filled pouch.

Pouch plates: Brood-pouch plates (ventrolateral extensions of sides of brood-pouch rings in adult males) are well developed in *Syngnathus* but obsolete in *Leptonotus*. Among genera treated here, pouch plates are well developed in *Parasyngnathus* and *Kaupus*, but vestigial or obsolete in the remainder.

Principal body ridges: In the Australian taxa, as well as *Leptonotus* and *Syngnathus*, the superior trunk and tail ridges are discontinuous near the rear of the dorsal-fin base, and inferior trunk and tail ridges are confluent. *Leptonotus*, known from New Zealand and South America (below ca. 23°S), is characterized by having the lateral trunk ridge confluent with the lateral tail ridge (Fig. 2a), a configuration that is not typical of any known Australian syngnathine pipefish. Except for some European and N. Pacific species wherein the lateral trunk and tail ridges are sometimes confluent, these ridges are typically discontinuous (Fig. 2b) in *Syngnathus*.

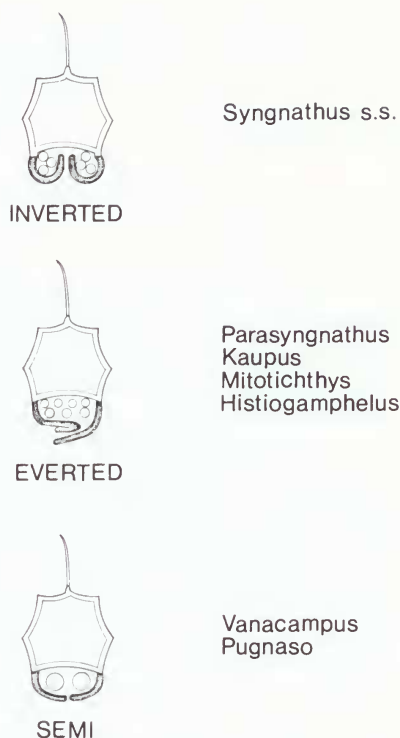


Figure 1. Cross-sectional diagrams of tail of brooding males illustrating types of brood-pouch closure occurring in *Syngnathus* s. s. and treated genera of Australian pipefishes.

This configuration is shared with a number of syngnathine genera, including those treated here and three others occurring in Australia (*Corythoichthys*, *Cosmocampus*, *Hypsogonathus*) which have been discussed by Dawson (1977, 1980) and Dawson and Glover (1982). A similar configuration occurs in *Hippichthys* Bleeker, also represented in Australia (Dawson, 1978a), but, in this case, the lateral trunk ridge is deflected ventrad to end just above the inferior ridge.

Opercular ridge: Although usually present in early juveniles, a distinct opercular ridge (Fig. 3) is lacking in subadults-adults of *Leptonotus*, *Syngnathus* and three of the present genera (*Pugnaso*, *Mitotichthys*, *Histiogamphelus*); in the others (*Parasyngnathus*, *Vanacampus*, *Kaupus*), this ridge is distinct and often completely crosses the opercle.

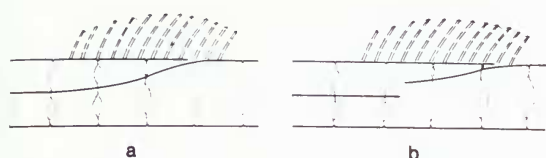


Figure 2. Configuration of principal body ridges in: (a)—*Leptonotus* and (b)—*Syngnathus* and treated Australian genera.

In summary, treated Australian genera are readily differentiated from *Syngnathus* s. s. by differences in type of pouch closure, and from *Leptonotus* by their different configuration of principal body ridges.

Methods and Materials

Measurements are in millimetres (mm) and are referred to head length (HL), standard length (SL) or total length (TL). Counts of trunk rings begin with that bearing the pectoral-fin base (pectoral ring) and end with that bearing the anus (anal ring). Tail ring counts begin with the 1st ring behind the anus (usually bearing the anal fin) and end with the penultimate ring, excluding the terminal element bearing the caudal fin. Subdorsal rings are estimated in $\frac{1}{4}$ -ring intervals before and behind the anterior margin of the 1st tail ring (0-point); these data have been grouped in 0.75-ring intervals (Tables 6-8). All fin-rays are counted separately. Other methods follow Dawson (1977). Morphological features mentioned in text are illustrated (Fig. 3). Colour descriptions are from specimens preserved in alcohol. As used here, the term "venter" is synonymous with the ventral surface of head or body. Distributions are largely based on material examined; depth is in metres (m). Synonymies are intended to be complete but some references may have been omitted inadvertently. Diagnoses of genera are based largely on characters of subadults-adults. Keys to genera and species are designed for the identification of late juvenile-adult specimens, and characters requiring determination of sex, state of maturity, or preserved colouration have been kept to a minimum.

Abbreviations for repositories of material examined are: AMNH—American Museum of Natural History, New York; AMS—Australian

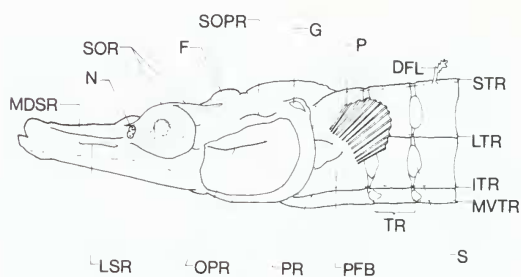


Figure 3. Lateral sections of a generalized pipefish delineating principal morphological features referenced in text. A—anal fin; AR—anal ring; D—dorsal fin; DFL—dermal flap; F—frontal ridge; G—gill opening; ITR—inferior tail ridge; LTR—lateral trunk ridge; LSR—lateral snout ridge; LTAR—lateral tail ridge; LTR—lateral trunk ridge; MDSR—median dorsal snout ridge; MVTR—median ventral trunk ridge; N—naris; OPR—opercular ridge; P—pectoral fin; PFB—pectoral-fin base; PR—pectoral ring; S—scutellum; SOPR—supraopercular ridge; SOR—supraorbital ridge; STAR—superior tail ridge; STR—superior trunk ridge; TAR—tail ring; TR—trunk ring.

Museum, Sydney; ANSP—Academy of Natural Sciences of Philadelphia; BMNH—British Museum (Natural History), London; BPBM—Bernice P. Bishop Museum, Honolulu; CAS—California Academy of Sciences, San Francisco; CAS-SU—former Stanford Univ. material now at CAS; CSIRO—CSIRO Fisheries Laboratory, Cronulla; FMNH—Field Museum of Natural

History, Chicago; GCRL—Gulf Coast Research Laboratory Museum; KFRS—Kanudi Fisheries Research Station, Papua New Guinea; MCZ—Museum of Comparative Zoology, Harvard University; MNHN—Muséum National d'Histoire Naturelle, Paris; NMV—National Museum of Victoria, Melbourne; NTM—Northern Territory Museum, Darwin; QM—Queensland Museum, Brisbane; QVM—Queen Victoria Museum and Art Gallery, Launceston; RMNH—Rijksmuseum van Natuurlijke Historie, Leiden; ROM—Royal Ontario Museum, Toronto; SAM—South Australian Museum, Adelaide; SMNS—Staatliches Museum für Naturkunde Stuttgart; TFDA—Tasmanian Fisheries Development Authority, Hobart; TM—Tasmanian Museum, Hobart; UM—University of Melbourne; UMMZ—University of Michigan Museum of Zoology, Ann Arbor; USNM—National Museum of Natural History, Smithsonian Institution, Washington, D.C.; WAM—Western Australian Museum, Perth; YCM—Yokosuka City Museum, Japan; ZMB—Zoologisches Museum, Museum für Naturkunde der Humboldt-Universität, Berlin.

KEY TO AUSTRALIAN GENERA OF
SYNGNATHINE (TAIL-POUCH) PIPEFISHES WITH
DISCONTINUOUS LATERAL TRUNK AND TAIL
RIDGES AND CONFLUENT INFERIOR RIDGES

- 1a. Lateral trunk ridge straight (Fig. 4a) 2
 1b. Lateral trunk ridge deflected ventrad near anal ring (Fig. 4b) *Hippichthys* Bleeker*
 2a. Snout slender in lateral aspect, the median dorsal ridge not elevated to or above horizontal through dorsal rim of orbit 3
 2b. Snout deep in lateral aspect, the median dorsal ridge elevated to or above horizontal through dorsal rim of orbit
 *Histiogamphelus* McCulloch
 3a. Opercular ridge vestigial or absent in subadults-adults 4
 3b. Opercular ridge typically distinct in subadults-adults 6
 4a. Snout long, its length 1.3-2.1 in HL 5
 4b. Snout short, its length 2.5-3.0 in HL
 *Pugnaso* Whitley
 5a. Snout essentially cylindrical; trunk rings 19-23; dorsal-fin base somewhat elevated
 *Mitotichthys* Whitley

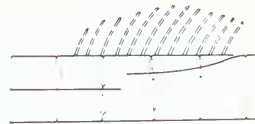


Fig. 4a

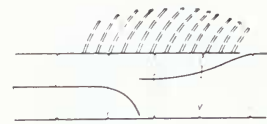


Fig. 4b

- 5b. Snout strongly compressed laterally; trunk rings 24-28; dorsal-fin base not elevated
 *Hypselognathus* Whitley*
 6a. Without lateral snout ridge or dermal flaps 7
 6b. With lateral snout ridge and/or dermal flaps *Cosmocampus* Dawson*
 7a. Subdorsal trunk rings <3.5; trunk not exceptionally deep in adult females 8
 7b. Subdorsal trunk rings >4.0; trunk exceptionally deep in adult females
 *Kaupus* Whitley
 8a. Pectoral-fin rays usually 13-18 (in 99% of specimens examined), modally 14-16 9
 8b. Pectoral-fin rays usually 8-13 (in 99%), modally 9-12 *Vanacampus* Whitley
 9a. Anal-fin rays 2-3; pouch plates present
 *Parasyngnathus* Duncker
 9b. Anal-fin rays 4; pouch plates absent
 *Corythoichthys* Kaup*

* Not treated here.

Parasyngnathus Duncker

Parasyngnathus Duncker, 1915: 79 [as subgenus of *Syngnathus* Linnaeus; type-species by original designation: *Syngnathus argyrostictus* Kaup, 1856 (= *S. penicillus* Cantor, 1849)].

Diagnosis: Median dorsal snout ridge low, not a high plate-like process extending above a horizontal through dorsal rim of orbit, usually terminating on anterior third of interorbital; supraopercular ridge usually present, sometimes obsolete; opercle typically with a complete, straight, longitudinal ridge; dorsum of trunk and tail essentially flat; principal body ridges distinct but not clearly elevated; superior trunk ridge not arched dorsad on subdorsal rings; usually with two ridges on pectoral-fin base; scutella with or without longitudinal keel-like ridges; dorsal-fin origin behind middle of last trunk ring, usually on tail, the fin-base not

elevated; trunk rings 15-17; total rings 51-57; dorsal-fin rays 23-31; total subdorsal rings 5.0-6.5; pectoral-fin rays 14-18; anal-fin rays 2-3; trunk depth of adult females little greater than that of adult males; pouch plates present; pouch closure the everted type (Fig. 1).

Comparisons: The combination of a complete opercular ridge, 14-18 pectoral-fin rays, everted pouch closure, presence of pouch plates, and absence of elevated snout ridge and dorsal-fin base distinguishes *Parasyngnathus* from other genera treated here.

Remarks: Duncker (1915) introduced *Parasyngnathus* as a subgenus of *Syngnathus* Linnaeus and later (1940) stated that this was the only subgenus of *Syngnathus* occurring in the Red Sea and tropical Indo-Pacific region. Whitley (1943), without comment, treated *Parasyngnathus* as a genus and incorrectly designated *Syngnathus spicifer* Rüppell (= *Hippichthys spicifer*) as the type-species. Whitley's treatment was not accepted by most subsequent workers, but the generic rank of *Parasyngnathus* was reaffirmed by Dawson (1981a). Duncker (1915) included two species groups with different principal body ridge configurations in *Parasyngnathus*, and one of these, including three species, was referred to the genus *Hippichthys* Bleeker by Dawson (1978a). Among the 12 other nominal species originally included by Duncker, three (*S. poecilolaemus*, *S. phillipi*, *S. margaritifera*) are here referred to *Vanacampus* Whitley, two (*S. kaupi*, *S. an-sorgii*) were referred to *Enneacampus* by Dawson (1981b), and *Syngnathus analicarens* Duncker was referred to *Bryx* Herald by Dawson (1981a). I remain uncertain as to the status of *Syngnathus macrophthalmus* Duncker from the Red Sea, but four names, considered as doubtful species by Duncker (1915), are now in synonymy or referred to other genera: *S. modestus* Sauvage (= *Vanacampus poecilolaemus*), *S. flavescens* Kaup (= *S. abaster* Risso), *S. fasciolatus* Duméril and *S. uncinatus* Weber (both = *Bhanotia fasciolata*).

Parasyngnathus appears to be most closely related to the genus *Hippichthys* Bleeker from which it differs principally in the configuration of the lateral trunk ridge (Figs. 4a-b). Species of

these taxa are similar in gross morphology, most appear to be euryhaline, and all are restricted to the Indo-Pacific region. *Parasyngnathus* could well be treated as a subgenus of *Hippichthys*, but generic rank is retained pending further study of higher relationships within the Syngnathidae. As understood here, *Parasyngnathus* includes *P. penicillus*, widely distributed in the tropical-subtropical Indo-Pacific region, and an endemic Australian species, *P. parvicarinatus*.

KEY TO THE SPECIES OF *PARASYNGNATHUS*

- 1a. Snout long, its length 1.5-2.4 in HL; snout depth usually more than 3 in snout length; trunk rings modally 16; scutella typically without keel-like ridges in subadults-adults (Fig. 5a) *penicillus*
- 1b. Snout short, its length 3.0-3.3 in HL; snout depth usually less than 2 in snout length; trunk rings modally 15; scutella typically with keel-like ridges in subadults-adults (Fig. 5b) *parvicarinatus*



Fig. 5a

Fig. 5b

Parasyngnathus penicillus (Cantor)

Figure 6, Plate 1

Syngnathus penicillus Cantor, 1849: 1368 (orig. descr.; Sea of Pinang); Bleeker, 1853: 6 (listed); Bleeker, 1858a: 13 (listed); Duméril, 1870: 549 (descr. compiled); Günther, 1870: 171 (descr.); Duncker, 1904: 188 (listed); Duncker, 1915: 84 (= *S. argyrostictus*); Fowler, 1938: 99 (compiled; references, in part).

Syngnathus argyrostictus Kaup, 1853: 231 (nomen nudum); Kaup, 1856: 33 (orig. descr.; Java); Bleeker, 1858b: 448 (listed); Bleeker, 1859: 187 (listed); Duméril, 1870: 542, 545 (in key, descr.); Duncker, 1910: 32 (descr.; Malay Peninsula, China, Japan); Weber and de Beaufort, 1922: 79, 82 (in key, synonym., descr., distr.); Hora, 1925: 461, Pl. 11, Fig. 6 (Madras, Goa); Reeves, 1927: 7

- (listed); Chen, 1935: 7 (in key, synonym, in part, descr.; Hong Kong); Herald, 1943: 39 (everted pouch closure); Chen, 1952: 306 (compiled); Matsubara, 1955: 426 (in key); Kamohara, 1957: 8 (colour note, Japan); Herald, 1959: 468 (everted pouch closure); Chen, 1960: 197 (descr.; Quemoy); Kamohara, 1964: 23 (Atsumi Bay, Japan to Formosa and Malaya); Kamohara and Yamakawa, 1965: 6 (Matsubara, Tekuzuky and Sōmachi, Japan); Lindberg and Legeza, 1965: 264 (in key, absent from Sea of Japan); Shiino, 1972: 62 (compiled); Tomiyama, 1972: 5 (refs., descr.; Mae-jima and Takamoku-jima, Japan); Dawson, 1978a: 133 (name only); Dawson, 1978b: 291 (compared with *S. gazella* and *S. parvicarinatus*); Jayaram, 1981: 304 (in Key, distr.).
- Syngnathus biserialis* Kaup, 1853: 232 (nomen nudum); Kaup, 1856: 33 (orig. descr., "probably = *S. argyrostictus*," India); Duncker, 1915: 84 (= *S. argyrostictus*).
- Corythoichthys penicillus*. Bleeker, 1859: 186 (n. comb., listed); Bleeker, 1861: 69 (compiled).
- Syngnathus spicifer* (not of Rüppell) Günther, 1870: 172 (in part, holotype of *S. biserialis* only).
- Syngnathus altirostris* Ogilby, 1890: 55 (orig. descr.; Moreton Bay, Qld. and Clarence River, N.S.W.); Waite, 1904: 18 (listed); Duncker, 1909: 244 (diagn.); McCulloch, 1929: 86 (compiled); Munro, 1958: 84, Fig. 581 (characters); Marshall, 1964: 114, Pl. 26, Fig. 122a-b (synon., descr., entering and living in freshwater); Marshall, 1966: 176, Pl. 26, Fig. 122a-b (colour note, distr.); Lake, 1971: 28 (distr., essentially marine but enters freshwater); Shiino, 1976: 109 (compiled); Parker, 1980: 193 (occasionally in freshwater in northern N.S.W. rivers).
- Corythoichthys quinquarius* Snyder, 1911: 526 (orig. descr.; Tanegashima, Japan); Snyder, 1912: 408, Pl. 52, Fig. 1 (notes; Tanegashima); Jordan et al., 1913: 97 (compiled, Kagoshima); Duncker, 1915: 84 (= *S. argyrostictus*); Okada, 1938: 158 (compiled); Kamohara, 1954: 269 (colour note; Takarajima).
- Syngnathus (Parasyngnathus) argyrostictus*. Duncker, 1915: 79, 84 (n. comb., type-species of *Parasyngnathus*, synonym, descr., distr.); Palmer, 1954: 28 (listed, Singapore).
- Corythoichthys altirostris*. McCulloch, 1921: 36 (n. comb., in key); McCulloch and Whitley, 1925: 137 (compiled); McCulloch, 1929: 86 (compiled).
- Parasyngnathus altirostris*. Whitley, 1943: 177 Fig. 8 (n. comb., lectotype selection, descr., distr.); Whitley, 1956: 40 (listed); Whitley and Allan, 1958: 59 (distr., entering freshwater); Whitley, 1964: 37 (listed).
- Hippichthys gazella* Whitley, 1947: 148 (orig. descr.; Broome, W.A.); Anon., 1963: 35 (listed).
- Parasyngnathus gazella*. Whitley, 1948a: 268, Fig. 5 (n. comb., descr., comparisons); Whitley, 1948b: 14 (compiled); Whitley and Allan, 1958: 59, Fig. (listed); Whitley, 1964: 38 (listed).
- Syngnathus gazella*. Munro, 1958: 84, Fig. 580 (n. comb., characters; W.A.); Dawson, 1978b: 291, Fig. 1 (characters, comparisons, possibly = *S. argyrostictus*).
- Parasyngnathus argyrostictus*. Dawson, 1981a: 90, Figs. 3-4 (n. comb., descr., comparisons, distr.).
- Diagnosis:** Trunk rings modally 16; snout length 1.5-2.4 in HL; scutella without keel-like ridges in subadults-adults.
- Description:** Rings 15-17 + 35-41 (usually 16 + 38-40 in Australia); dorsal-fin rays 23-31 (usually 26-29 in Australia); dorsal-fin origin between posterior half of last trunk ring and posterior fourth of 2nd tail ring, usually on tail; total subdorsal rings 5.0-7.25; pectoral-fin rays 14-18, see Tables 1-8 for additional counts. Proportional data, based on 60 Australian specimens, 59.0-172.0 (\bar{x} = 116.5) mm SL, follow: HL in SL 5.6-8.0 (6.7), snout length in HL 1.5-2.2 (1.8), snout depth in snout length 3.3-7.8 (5.7), length of dorsal-fin base in HL 1.3-2.0 (1.7), anal ring depth in HL 3.7-6.2 (4.9), trunk depth in HL 2.4-4.1 (3.4), pectoral-fin length in HL 6.4-9.5 (8.0). Scutella without longitudinal keel-like ridges in subadults-adults, poorly defined keels infrequently present in specimens < 80 mm SL.

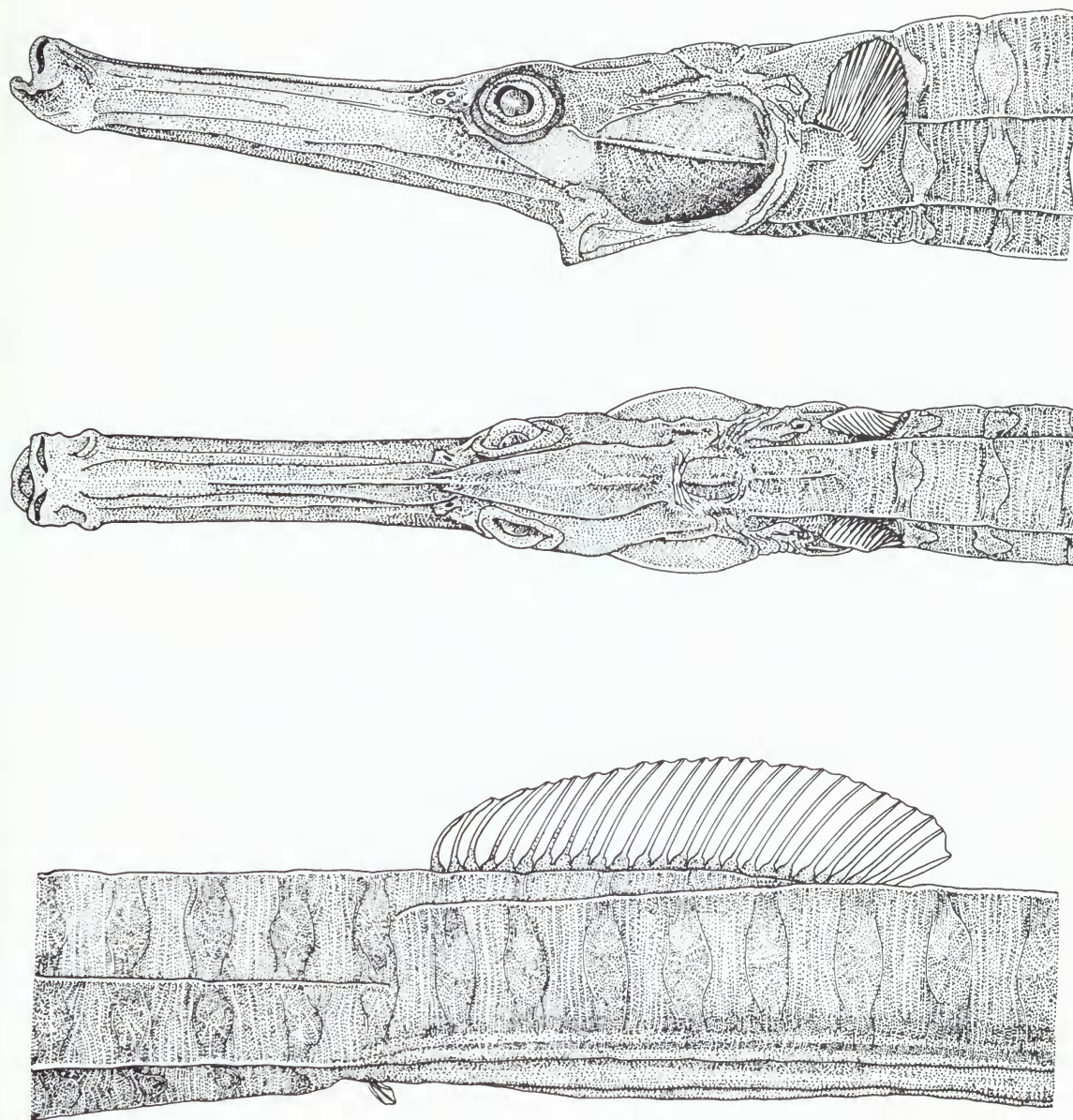


Figure 6. *Parasyngnathus penicillus*. Lateral and dorsal aspects of head and anterior trunk rings, together with lateral section of body illustrating configuration of principal ridges, fin positions, and anterior portion of brood pouch. From adult male, 132 mm SL (GCRL 15717).

Colouration: Light tan to brownish; usually with a dark lateral stripe on snout and a narrow pale stripe on opercular ridge, often with dark spots or shading on lower half of snout; dorsum plain, mottled or blotched, sometimes with indications of about 10 narrow pale bars separated by 3-5 ring darker interspaces; sides of trunk typically with 5-7 irregular rows of brownish ocelli; sides of tail plain or mottled, usually with a semicircular pale blotch adjacent to inferior ridge of most rings; dorsal-fin rays plain or shaded with brown; pectoral-fin rays usually edged with brown; caudal fin brownish with pale distal margin.

Comparisons: Characters in key and diagnosis distinguish *P. penicillus* from its only congener, *P. parvicarinatus*.

Geographic variation: West to east clinal variation in meristic values has been demonstrated for several Indo-Pacific pipefishes (Dawson, 1977, 1981c), and present data (Tables 9, 10) indicate similar variation in *P. penicillus*. Frequencies of tail rings and total rings are lowest in material from the Arabian Gulf and highest in samples from Japan and Queensland. Frequencies of dorsal- and pectoral-fin rays show less variation, but the Queensland population has slightly higher values than material from other areas.

Although agreeing with other populations in meristic values and colouration, specimens from Japan (Pl. 1) and China have a somewhat shorter snout. Compared with Australian material, representative of the typical long-snouted form, 43 Japanese fish (\bar{x} = 107.6 mm SL) have higher average HL in SL and snout length in HL ratios (respectively, 8.9 and 2.2 versus 6.7 and 1.8) and a lower average snout depth in snout length ratio (4.0 versus 5.7). In the apparent absence of other distinguishing features, I do not consider these differences sufficient for separate taxonomic treatment. If future studies show that subspecific status is warranted, Snyder's (1911) name, *quinquarius*, is available for the short-snouted population.

Remarks: Duncker (1915) referred *Syngnathus penicillus* Cantor 1849 to the synonymy of *S. argyrostictus* Kaup 1856, but there is no justifiable basis for this action and Cantor's

name has priority. The holotype of *S. penicillus* (BMNH 1860.3.19.526), conspecific with the holotype of *S. argyrostictus*, is a dried male specimen (89.5 mm overall length) which lacks part of the tail and much of the right side of the body. There are 17 trunk rings, 33 tail rings remain, the right pectoral fin is missing and the left fin is damaged. There is a complete ridge on the opercle, dorsal fin originates near the middle of the 1st tail ring and there are at least 25 dorsal-fin rays. Snout length is about 1.7 in HL and snout depth is 6.4 in snout length. Cantor (1849) described the holotype as having 6 caudal-fin rays, but, as noted by Duncker (1915), the tail was evidently regenerated.

The brood pouch extends below the anterior 15-24 tail rings in 42 examined males (79-149 mm SL). One fish (107 mm SL) has about 100 pouch eggs deposited in a single layer of two rows through 15 of 17 pouch rings, whereas another (128.5 mm SL) has about 70 embryos in each of 8-9 transverse rows through 20 of 22 pouch-rings.

Distribution: Known from the western Arabian Gulf to Honshu I., Japan and Australia. Most collections are from the lower reaches of streams and rivers, from estuaries and from other shallow inshore habitats. Australian records are from the Dampier Archipelago and Broome, Western Australia, from the East Alligator River and the vicinity of Darwin, Northern Territory, and from Cape York, Queensland to the vicinity of Newcastle, New South Wales.

Material examined: Two hundred and five specimens, 48-172 mm SL, including holotype.

Holotype: BMNH 1860.3.19.526 (damaged male, 89.5 mm overall length), Sea of Pinang (Malay Peninsula), July 1845, Cantor.

Other material: Arabian Gulf, Kuwait: GCRL 16282 (1, 55.5), GCRL 19015 (1, 86.5), GCRL 19016 (1, 87.5). Saudi Arabia: USNM 164344 (1, 99.5). India, Gulf of Cutch: CAS 39748 (3, 71-79). Thailand, Andaman Sea, near Pakchan R.: CAS 39650 (1, 82.5). Gulf of Siam: CAS 39646 (2, 69.5-116), CAS 39647 (1, 132), GCRL 15717 (2, 102.5-132). Indonesia, Borneo: AMS 1.19355-010 (4, 57-123.5). Java: RMNH 3849 (121, male, holotype of

Syngnathus argyrostictus). Philippine Is.: ANSP 48644 (1, 119.5), USNM 217520 (1, 53.5). China, Shanghai: FMNH 83876 (17, 111-159), GCRL 16749 (2, 145.5-148). Japan, Tanegashima I.: CAS-SU 22256 (16, 77-117.5), USNM 68227 (121, male, holotype of *Corythoichthys quinquarius*). Kyūshū I.: GCRL 17853 (6, 82-149.5), GCRL 17854 (7, 70-106.5), GCRL 17963 (31, 51.5-129), GCRL 18249 (5, 48-60), UMMZ 205280 (2, 83-94.5). Honshu I.: FMNH 83878 (1, 122), GCRL 17437 (1, 127.5), UMMZ 205277 (1, 137), YCM P.5985 (1, 109). Loc. uncertain: YCM P.5972 (1, 118), YCM P.5976 (1, 117), YCM P.5979 (2, 90-129), YCM P.5992 (1, 142), YCM P.5993 (2, 131-140), YCM P.5995 (1, 140), YCM P.5997 (1, 140). Papua New Guinea, Meiro R.: BPBM 13649 (1, 139). Varoi R.: KFRS F.4661.12 (1, 100). Australia, W.A.: WAM P.2871 (75.5, juvenile, holotype of *Hippichthys gazella*), WAM P.25118-013 (1, 114.5), WAM P.25668-011 (1, 76), WAM P.27488-001 (1, 143.5), WAM P.27490-001 (1, 59). N.T.: AMNH 35964 (2, 60.5-64), CSIRO uncat. (4, 55-92.5), GCRL 15541 (1, 62.5), NTM S.10020-009 (1, 77.5), NTM S.10414-001 (1, 53.5). Qld.: AMS I.385 (130, female, lectotype of *Syngnathus altirostris*), AMS I.22720-001 (3, 86.5-120.5), AMS I.22721-001 (1, 102), AMS I.22789 (29, 78-161.5), AMS I.22083-003 (1, 75.5), AMS IA.7982 (1, 143), GCRL 18542 (8, 97.5-147.5), NMV A.676 (1, 152.5), QM I.2932 (1, 100.5), QM I.4997 (1, 113), QM I.6591 (1, 88), QM I.7336 (1, 104), QM I.7988 (1, 139.5), QM I.8004 (1, 149.5), QM I.8045 (1, ca. 140), QM I.8208 (1, 119), QM I.10979 (2, 129-146), QM I.17855 (1, 133), QM I.18086 (1, 119.5), ROM 39318 (2, 102.5-140), WAM P.26981-006 (2, 70-108). N.S.W.: AMS B.7063 (damaged male, 143 mm overall, paralectotype of *S. altirostris*), AMS I.19231-001 (1, 92), AMS IA.4520 (1, 114), AMS IA.5098 (1, 172), AMS IA.5099 (1, 152), AMS IB.4211 (1, 129.5). Loc. uncertain: BMNH 1982.5.12.1 (125, female, holotype of *S. biserialis*, China or India, Hardwick col.).

***Parasyngnathus parvicarinatus* (Dawson)**

Plate 2

Syngnathus parvicarinatus Dawson, 1978b: 288, Figs. 1-2 (orig. descr.; Darwin, N.T.).

Diagnosis: Trunk rings modally 15; snout length 3.0-3.3 in HL; scutella with keel-like ridges in subadults-adults.

Description: Rings 15 + 36-38, dorsal-fin rays 24-27, dorsal-fin origin between rear margins of last trunk ring and 1st tail ring, total subdorsal rings 5.0-6.0, pectoral-fin rays 14-17, see Tables 1-8 for additional counts. Proportional data, based on 11 specimens 53.5-78.5 (\bar{x} = 63.4) mm SL, follow: HL in SL 8.5-9.2 (8.9), snout length in HL 3.0-3.3 (3.1), snout depth in snout length 1.5-1.9 (1.7), length of dorsal-fin base in HL 1.2-1.4 (1.3), anal ring depth in HL 3.0-3.9 (3.4), trunk depth in HL 2.2-2.8 (2.6), pectoral-fin length in HL 5.7-6.7 (6.1). Scutella with prominent keel-like ridges in subadults-adults.

Colouration: Light tan to brown; head streaked or blotched with brown; dorsum and upper part of side of trunk plain or somewhat mottled; dorsum of tail sometimes shading to dark brown distally, sometimes with 2-3 diffuse pale bars; lower part of side and venter of trunk usually with a dark bar on anterior part of each ring; dorsal and pectoral fins hyaline; caudal fin brown with pale margin.

Comparisons: Characters in key and diagnosis distinguish this species from its only congener, *P. penicillus*.

Remarks: Males may have the brood pouch developed at 78.5 mm SL; probably fails to exceed 100-125 mm SL.

Distribution: Known only from the East Alligator River and from tidepools in Dinah Beach Inlet, Darwin, Northern Territory. This species is sympatric with *P. penicillus* in both localities.

Material examined: Fourteen specimens, 40.5-78.5 mm SL, including holotype and 11 paratypes.

Holotype: WAM P.25801-001 (78.5, male), Dinah Beach Inlet, Darwin, N.T., 18 May 1969, D. E. Rosen and party.

Paratypes: AMNH 35963 (6, 44.5-73), AMS I.20563-001, formerly AMNH 35963 (2, 55-57), GCRL 15644 (2, 70-73), and USNM 217594 (1, 65); all taken with holotype.

Other material: Australia, N.T.: CSIRO uncat. (2, 40.5-44.5).

Table 1. Frequency distributions of trunk rings in Australian species of *Parasyngnathus*, *Vanacampus*, *Pugnaso*, *Kaupus*, *Mitotichthys* and *Histiogamphelus*.

Genus	Trunk rings									
	Species	15	16	17	18	19	20	21	22	23
<i>Parasyngnathus</i>										
<i>penicillus</i>	6	70	1							
<i>parvicarinatus</i>	14*									
<i>Vanacampus</i>										
<i>vercoi</i>		17*								
<i>phillipi</i>			20	124	41	6				
<i>margaritifera</i>				8	55	2				
<i>poecilolaemus</i>				2	29	15				
<i>Pugnaso</i>										
<i>curtirostris</i>			1	111*	7					
<i>Kaupus</i>										
<i>costatus</i>		13*	23	1						
<i>Mitotichthys</i>										
<i>tuckeri</i>								3	6	2*
<i>semistriatus</i>						3*	32			
<i>meraculus</i>							2*			
<i>mollisoni</i> ¹							1*			
<i>Histiogamphelus</i>										
<i>briggsii</i>							1	32	4*	
<i>cristatus</i>				1	4	4				

* Primary type.

¹ Data from orig. descr.

Vanacampus Whitley

Vanacampus Whitley, 1951a: 62 (as subgenus of *Parasyngnathus* Duncker; type-species by original designation: *Syngnathus vercoi* Waite and Hale, 1921).

Diagnosis: Median dorsal snout ridge low, not a high plate-like process extending above a horizontal through dorsal rim of orbit, usually terminating near middle of interorbital; opercle typically with a complete, straight, longitudinal ridge; supraopercular ridge present; dorsum of trunk and tail flat to somewhat depressed between superior ridges; principal body ridges distinct, sometimes a little elevated, superior trunk ridge not arched dorsad on subdorsal rings; with 1-2 ridges on pectoral-fin base; scutella without keel-like ridges; dorsal-fin origin on trunk or tail, fin-base not elevated;

trunk rings 16-20, total rings 53-71; dorsal-fin rays 19-31; total subdorsal rings 4.25-8.0; pectoral-fin rays 8-14; anal-fin rays 3-4; trunk depth of adult females little greater than that of adult males; pouch plates absent or vestigial; pouch closure the semi type (Fig. 1).

Comparisons: The combination of a complete opercular ridge, 8-14 pectoral-fin rays, semi type of pouch closure, absence of elevated snout ridge and dorsal-fin base, and absence of well-developed pouch plates distinguishes *Vanacampus* from other genera treated here.

Remarks: Whitley (1951a) referred the type-species (*Syngnathus vercoi*) to the genus *Parasyngnathus* Duncker, and diagnosed *Vanacampus* solely on the basis of the short snout and lower number of dorsal-fin rays of *Syngnathus vercoi*. Such differences alone are

inadequate for subgeneric or generic distinction of any pipefish, but Whitley's name (*Vanacampus*) is available for the genus diagnosed here. Although *V. vercoi* has fewer trunk rings, dorsal-fin rays, total subdorsal rings, a shorter snout, and a more posterior dorsal-fin origin than congeners, I find no justification for affording separate status to this species.

This endemic Australian genus includes four marine-estuarine species.

KEY TO THE SPECIES OF *VANACAMPUS*

- 1a. Trunk rings 17-20, modally 18-19; total subdorsal rings 5.5-8.0; snout length 1.6-2.4 in HL 2
- 1b. Trunk rings 16; total subdorsal rings 4.25-5.0; snout length 2.6-2.8 in HL *vercoi*
- 2a. Tail rings 38-51 (39 or more in 99.6%); subdorsal tail rings 4.5-6.75 (5.0 or more in 98%) 3
- 2b. Tail rings 34-38 (37 or fewer in 89%); subdorsal tail rings 3.5-5.25 (4.75 or fewer in 89%) *margaritifer*
- 3a. Total rings 55-65 (63 or fewer in 98%); pectoral-fin rays 9-12 (modally 10); snout depth averages 5.5 in snout length; pectoral-fin length averages 6 in HL *phillipi*
- 3b. Total rings 64-71 (65 or more in 94%); pectoral-fin rays 11-14 (modally 12); snout depth averages 8.4 in snout length; pectoral-fin length averages 8 in HL *poecilolaemus*

Vanacampus vercoi (Waite and Hale)

Figure 7, Plate 2

Ichthyocampus filum (not of Günther) Zietz, 1908: 298 (misident., listed; Spencer Gulf, S.A.).

Syngnathus vercoi Waite and Hale, 1921: 293, 295, 298, Fig. 41 (in keys, orig. descr.; Spencer Gulf, S.A.); Whitley, 1951a: 62 (type-species of *Vanacampus*); Munro, 1958: 83, Fig. 574 (characters); Scott, 1962: 117, 118, Fig. (in key, comparisons); Scott et al., 1974: 132, Fig. (in key, comparisons); Glover, 1976: 171 (compiled); Glover, 1979: 150 (listed).

Corythoichthys vercoi. McCulloch, 1929: 87 (n. comb., compiled).

Corythoichthys vercoi. Scott, 1939: 141 (emendation, in key).

Parasyngnathus (Vanacampus) vercoi. Whitley, 1951a: 62 (n. comb., as type-species of *Vanacampus*); Whitley and Allan, 1958: 59 (listed); Whitley, 1964: 38 (listed).

Corythoichthys flindersi. Scott, 1957: 182, Fig. 2 (orig. descr.; Pelican Lagoon, Kangaroo I., S.A.); Scott, 1966: 93 (note on opercular ridge); Glover, 1976: 171 (compiled).

Syngnathus flindersi. Munro, 1958: 84, Fig. 582 (n. comb., characters); Scott, 1962: 117, Fig. (in key, characters); Scott, 1971: 123 (note on opercular ridge); Scott et al., 1974: 132, Fig. (in key, characters); Pelican Lagoon, Kangaroo I.; Glover, 1979: 139, 147, 150 (among vegetation, Kangaroo I.).

Parasyngnathus (Vanacampus) flindersi. Whitley and Allan, 1958: 59 (n. comb., listed); Whitley, 1964: 38 (listed).

Diagnosis: Trunk rings modally 16; total subdorsal rings 4.25-5.0; HL averages 10.0 in SL; snout length 2.6-2.8 in HL.

Description: Rings 16 + 40-42, dorsal-fin rays 19-21, dorsal-fin origin between posterior half of last trunk ring and posterior margin of 1st tail ring, usually at anterior margin of 1st tail ring; total subdorsal rings 4.25-5.0; pectoral-fin rays 8-9 (usually 9), see Tables 1-8 for additional counts. Proportional data, based on 9 specimens 66.5-101.5 (\bar{x} = 84.1) mm SL, follow: HL in SL 9.6-10.6 (10.0), snout length in HL 2.6-2.8 (2.7), snout depth in snout length 2.8-3.2 (3.0), length of dorsal-fin base in HL 1.2-1.5 (1.4), anal ring depth in HL 2.4-3.3 (2.9), trunk depth in HL 2.0-2.7 (2.3), pectoral-fin length in HL 4.3-5.1 (4.7).

Colouration: Largely brownish; lower half of opercle often with pale spots or bars; venter of head mostly pale; dorsum of body plain or with 4-6 widely spaced, narrow (one ring), pale bars; sides of trunk usually with prominent brown bars on anterior half of each ring; venter of trunk often with a few pale spots or blotches on pectoral ring, elsewhere mainly plain; sides and venter of tail plain, spotted or mottled; dorsal-

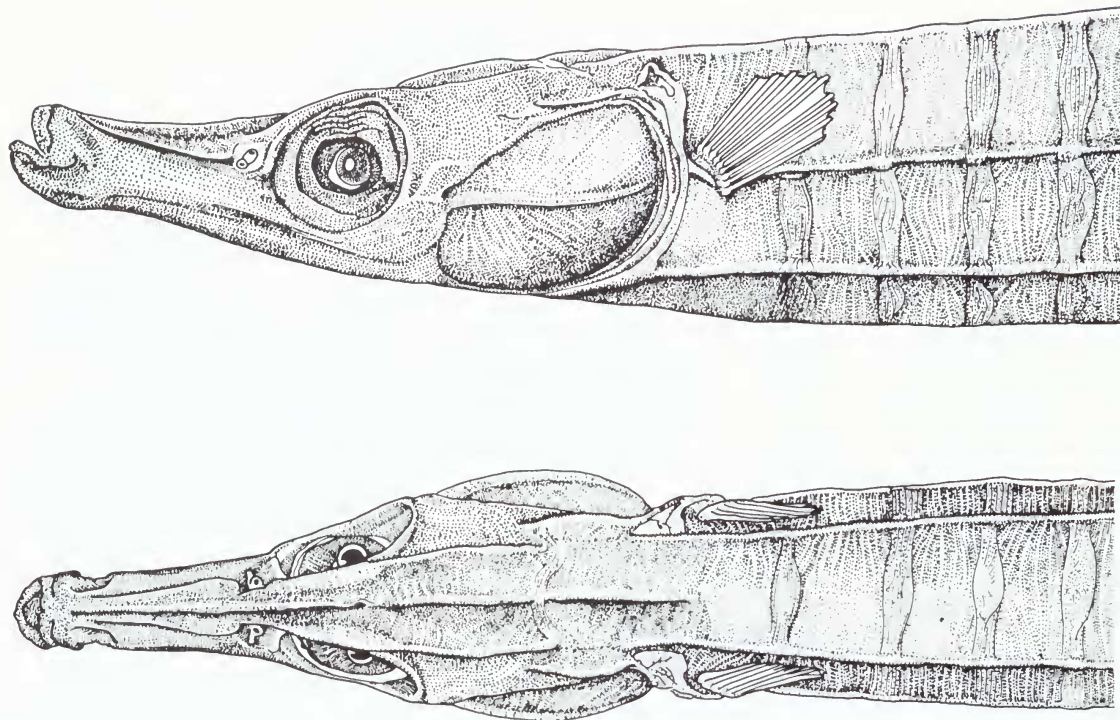


Figure 7. *Vanacampus vercoi*. Lateral and dorsal aspects of head and anterior trunk rings. From adult male, 101.5 mm SL (AMS 1.20193-006).

fin rays edged with 3-5 pairs of fine brown lines; pectoral fin shaded with brown or with fine brown edging on fin-rays; caudal fin brown with pale margin.

Comparisons: Characters in key and diagnoses distinguish *V. vercoi* from congeners. Two other short-snouted pipefishes, *Kaupus costatus* and *Pugnaso curtirostris*, have been confused with this species, and all three may be expected in a single sample. *Vanacampus vercoi* has fewer dorsal-fin rays than *Kaupus costatus* (19-21 versus 30-36), and is readily distinguished from *Pugnaso curtirostris* by a lower modal trunk ring count (16 versus 18) and by the complete opercular ridge (absent in subadults-adults of *P. curtirostris*).

Remarks: Waite and Hale (1921) gave counts of 16+43 rings and 10 pectoral-fin rays for the holotype and noted that their material included "several other examples". I find the holotype

(now 101.5 mm SL) to have 16+41 rings and 9 rays in each pectoral fin. Glover (1976) listed 18 paratypes in SAM F.691, but I find only 15 specimens, including one *Pugnaso curtirostris*, in this lot.

Scott (1957) described *Corythoichthys flindersi* from two female specimens (91 and 94 mm TL), gave counts of 15+40 rings, 21 dorsal-fin rays and 12 pectoral-fin rays, and noted the presence of "two distinct keels" on the operculum. The holotype (SAM F.2922), now lacking caudal fin and part of the tail, has 16 trunk rings, 21 dorsal-fin rays and 9 rays in each pectoral fin. The paratype (CAS 20750), now in very poor condition, has 16+42 rings, 21 dorsal-fin rays and 9 rays in each pectoral fin. Neither fish has two ridges on the operculum, and I find these specimens to be conspecific with *Vanacampus vercoi*.

The holotype of *V. vercoi* has the brood pouch extending below the anterior 14 tail rings. The pouch eggs are lost but the pouch retains ca. 20 membranous egg-compartments in two transverse rows through 12 pouch rings.

The pouch extends below 14-16 rings in two other examined males (88-101.5 mm SL). This pipefish probably fails to exceed 125 mm SL. Scott et al. (1974) described this species as very common, but there are few specimens in collections.

Distribution: Known only from Spencer Gulf, Gulf St. Vincent and Kangaroo I., South Australia. Available data indicate collections among "weed" and "seagrass" in depths of 2-3 m.

Material examined: Twenty-three specimens, 65-104 mm SL, including holotype and fourteen paratypes.

Holotype: SAM F.690 (101.5, adult male), Spencer Gulf, S.A., dredge, 7 Dec. 1920, J. Verco.

Paratypes: SAM F.691 (14, ca. 65-104), taken with holotype.

Other material: Australia, S.A.: AMS I.20193-006 (2, 72.5-101.5), CAS 20750 (1, 86, paratype of *Corythoichthys flindersi*), SAM F.2427 (2, 65-76.5), SAM F.2922 (damaged female, holotype of *C. flindersi*), SAM F.3584 (1, 91.5), SAM F.3918 (1, 66.5).

***Vanacampus margaritifer* (Peters)**

Plate 3

Syngnathus margaritifer Peters, 1859: 457 [orig. descr.; Sydney (N.S.W.)]; Duméril, 1870: 550, 566 (in key, descr. compiled); Günther, 1870: 171 (characters, Port Jackson); Castelnau, 1875: 48 (colour note, Qld.); Castelnau, 1879: 356, 360 (listed, Australian endemic); Macleay, 1882: 289 (characters compiled); Tenison-Woods, 1882: 23 (listed); Waite, 1904: 18 (listed); Duncker, 1909: 245 (characters; N.S.W. and Bowen and Boston I., Qld.); Fowler, 1931: 323 (refs. only); Munro, 1958: 83, Fig. 576 (characters, range); Kähnsbauer, 1978: 312 (characters; Boston I., Qld. (Godeffroy col.) to Sydney).

Corythoichthys margaritifer. McCulloch, 1911: 26 (n. comb., close to *C. phillipi*).

Syngnathus (Parasyngnathus) margaritifer. Duncker, 1915: 29, 83 (n. comb., descr., range).

Corythoichthys margaritifer. McCulloch, 1921: 36 (emendation, in key); McCulloch and Whitley, 1925: 137 (compiled); McCulloch, 1929: 87 (compiled).

Hippichthys margaritifer. Whitley, 1940: 414, Fig. 22 (n. comb.; Bowen, Qld.).

Parasyngnathus margaritifer. Whitley and Allan, 1958: 59 (n. comb.; Qld., N.S.W.); Whitley, 1964: 38 (listed).

Diagnosis: Trunk rings modally 19; tail rings 35-38; subdorsal tail rings 3.5-5.25 (usually 4.75 or fewer); HL averages 8.2 in SL; without a bar-like series of short pale stripes on side of anterior tail rings.

Description: Rings 18-20+34-38, dorsal-fin rays 22-26, subdorsal rings 2.75-1.0+3.5-5.25=5.5-6.75, pectoral-fin rays 10-12 (modally 11), see Tables 1-8 for additional counts. Proportional data, based on 30 specimens 84.0-152.0 (\bar{x} =136.9) mm SL, follow: HL in SL 7.5-9.1 (8.2), snout length in HL 1.8-2.3 (1.9), snout depth in snout length 4.5-7.8 (5.8), length of dorsal-fin base in HL 1.2-1.6 (1.4), anal ring depth in HL 3.5-5.1 (4.1), trunk depth in HL 2.7-4.5 (3.5), pectoral-fin length in HL 5.1-7.9 (6.6).

Colouration: Tan to dark brown; opercle usually with an irregular pale stripe or blotch along longitudinal ridge, head elsewhere plain or irregularly blotched; dorsum of body usually with indications of 12-13 diffuse pale bars (ca. one ring wide) separated by 3-5 ring darker interspaces; side of trunk typically with a small pale ocellus or blotch on each scutellum and with a small pale spot or blotch near middle of lateral and inferior ridges of each ring; venter of trunk often plain, median ridge sometimes dark brown; side and venter of tail plain or irregularly flecked with pale. Dorsal fin hyaline, irregularly shaded with brown or with indications of short brownish bars on each fin-ray; pectoral-fin rays usually edged or shaded with brown; caudal fin brown with pale distal margin.

Comparisons: Among congeners, *V. margaritifer* is most similar to *V. phillipi*. Both these species overlap in meristic values, as well as in geographic range. In addition to

Table 2. Frequency distributions of tail rings in Australian species of *Parasyngnathus*, *Vanacampus*, *Pugnaso*, *Kaupus*, *Mitotichthys* and *Histiogamphelus*.

Genus	Tail rings																								
	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	
<i>Parasyngnathus</i>																									
<i>penicillus</i>										2	18	35	20	2											
<i>parvicarinatus</i>								3	9	2*															
<i>Vanacampus</i>																									
<i>vercoi</i>												3	10*	4											
<i>phillipi</i>										1	9	19	25	33	46	41	15	2							
<i>margaritifera</i>					1	27	24	7	6																
<i>poecilolaemus</i>															1	7	9	4	18	5	1	1			
<i>Pugnaso</i>																									
<i>curtirostris</i>														11	19	54	35*								
<i>Kaupus</i>																									
<i>costatus</i>								6	8	14*	9														
<i>Mitotichthys</i>																									
<i>tuckeri</i>													1	7*	3										
<i>semistriatus</i>																									
<i>meraculus</i>																									
<i>mollisoni</i> ¹					1	1*																			
<i>Histiogamphelus</i>																									
<i>briggsii</i>										4	17	9*	6	1											
<i>crisatus</i>	2	3	4																						

* Primary type.

¹ Data from orig. descr.

Table 3. Frequency distributions of total rings in Australian species of *Parasyngnathus*, *Vanacampus*, *Pugnaso*, *Kaupus*, *Mitotichthys* and *Histiogamphelus*.

Genus Species	Total rings																									
	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	
<i>Parasyngnathus</i>																										
<i>penicillus</i>							2	21	34	18	2															
<i>parvicarinatus</i>					3	9	2*																			
<i>Vanacampus</i>																										
<i>vercoi</i>										3	10*	4														
<i>phillipi</i>									1	2	6	14	24	35	43	42	20	3	1							
<i>margaritifera</i>							2	30	21	8	4															
<i>poecilolaemus</i>																	3	12	6	16	6	1	1	1	1	
<i>Pugnaso</i>																										
<i>curitrostris</i>												10	19	53	35*	2										
<i>Kaupus</i>																										
<i>costatus</i>						2	8	6*	16	4	1															
<i>Mitotichthys</i>																										
<i>tuckeri</i>																2	6	3*								
<i>semistriatus</i>																		1	7	8*	14	3	2			
<i>meraculus</i>										1	1*															
<i>mollisoni</i> ¹																										1*
<i>Histiogamphelus</i>																										
<i>briggsii</i>																										
<i>cristatus</i>	3	1	1	1	1	3																				

*Primary type.

¹Data from orig. descr.

Table 4. Frequency distributions of dorsal-fin rays in Australian species of *Parasyngnathus*, *Vanacampus*, *Pugnaso*, *Kaupus*, *Mitotichthys* and *Histiogamphelus*.

Genus	Dorsal-fin rays																						
	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	
<i>Parasyngnathus</i>																							
<i>penicillus</i>							1	3	24	33	16												
<i>parvicarinatus</i>						1	3	5*	5														
<i>Vanacampus</i>																							
<i>vercoi</i>	1	6*	6																				
<i>phillipi</i>			6	23	48	52	45	13	1	1													
<i>margaritifera</i>			3	8	30	21	3																
<i>poecilolaemus</i>							1		12	14*	17	4	2										
<i>Pugnaso</i>																							
<i>curtirostris</i>			1	14	59*	34	8																
<i>Kaupus</i>																							
<i>costatus</i>													1	8	10	9	5	4	2				
<i>Mitotichthys</i>																							
<i>tuckeri</i>																							
<i>semistriatus</i>																							
<i>meraculus</i>																							
<i>mollisoni</i> ¹																							
<i>Histiogamphelus</i>																							
<i>briggsii</i>								5*	16	11	4	1											
<i>crisatus</i>					1	1	5	2															

*Primary type.

¹Data from orig. descr.

Table 5. Frequency distributions of pectoral-fin rays in Australian species of *Parasyngnathus*, *Vanacampus*, *Pugnaso*, *Kaupus*, *Mitotichthys* and *Histiogamphelus*.

Genus	Pectoral-fin rays											
	Species	8	9	10	11	12	13	14	15	16	17	18
<i>Parasyngnathus</i>												
<i>penicillus</i>									13	84	43	5
<i>parvicarinatus</i>								2	12*	8	4	
<i>Vanacampus</i>												
<i>vercoi</i>	2	29*										
<i>phillipi</i>		62	171	78	28							
<i>margaritifer</i>			5	88	29							
<i>poecilolaemus</i>				10*	70*	15	1					
<i>Pugnaso</i>												
<i>curtirostris</i>	7	148	51*	4								
<i>Kaupus</i>												
<i>costatus</i>		11	62*	1								
<i>Mitotichthys</i>												
<i>tuckeri</i>			1	14*	7							
<i>semistriatus</i>					19	43*	2*					
<i>meraculus</i>						2						
<i>mollisoni</i> ¹												1*
<i>Histiogamphelus</i>												
<i>briggsii</i>				2	27	40*	5					
<i>cristatus</i>				1	13	3						

*Primary type.

¹Data from orig. descr.

characters in the key and diagnoses, most subadult-adult specimens of *V. margaritifer* differ from those of *V. phillipi* in the more or less regular arrangement of pale spots on the trunk rings (spots absent or irregular in *V. phillipi*). Furthermore, specimens of *V. margaritifer* tend to have a longer snout (snout length in HL averages 1.9 versus 2.1 in *V. phillipi*), a higher average snout depth in snout length ratio (5.8 versus 5.5 in *V. phillipi*), and brooding males tend to have more pouch eggs (maximum number ca. 100 versus <50 in examined *V. phillipi*).

Remarks: Peters (1869) based his original description on single male and female specimens from Sydney. His counts and measurements are evidently those of the male alone. This fish (ZMB 5035) was described as

having 20+35 rings, 21 dorsal-fin rays and 9 caudal-fin rays, but I count 19+36 rings, 24 dorsal-fin rays and 10 rays in the damaged caudal fin. I have been unable to locate the female syntype.

The brood pouch extends below the anterior 13-18 tail rings in 23 males (91.5-152 mm SL), with the smallest examined brooding male measuring 129 mm SL. In two males (129 mm SL), pouch eggs are deposited in a single layer of four transverse rows with 25-26 eggs in each row and each row extends across 14 of 15 pouch rings. Young are ca. 10.1 mm SL when ready to leave the brood pouch.

Present specimens do not show significant geographic variation in colouration or meristic values.

Distribution: Based on material examined, *V.*

Table 6. Frequency distributions of subdorsal trunk rings in Australian species of *Vanacampus*, *Pugnaso*, *Kaupus*, *Mitotichthys* and *Histiogamphelus*. Dorsal fin located on tail in examined Australian specimens of *Parasyngnathus*.

Genus Species	Subdorsal trunk rings													
	10.25	9.50	8.75	8.00	7.25	6.50	5.75	5.00	4.25	3.50	2.75	2.00	1.25	0.50
<i>Vanacampus</i>														
<i>vercoi</i>														3
<i>phillipi</i>												8	124	69
<i>margaritifera</i>											9	41	16	
<i>poecilolaemus</i>												2	40*	8
<i>Pugnaso</i>														
<i>curtirostris</i>												3	66	58*
<i>Kaupus</i>														
<i>costatus</i>							12	24*	4					
<i>Mitotichthys</i>														
<i>tuckeri</i>	5*		5		1									
<i>semistriatus</i>										1	11	23*		
<i>meraculus</i>										1*	1			
<i>mollisoni</i> ¹												1*		
<i>Histiogamphelus</i>														
<i>briggsii</i>							4	18*	15					
<i>crisatus</i>							4	5						

*Primary type.

¹Data from orig. descr.

margaritifera occurs from the vicinity of Southport, Queensland to Port Phillip Bay, Victoria and, provisionally, off Rottne I., Western Australia. The latter record is based on two fish (21.5 and 126 mm SL) with 19+37 rings and 3.5-4.0 subdorsal tail rings collected from floating *Sargassum* sp. There are no specimens known from South Australia or Tasmania, and records from Bowen and Boston I. in northern Queensland (Duncker, 1909) cannot be confirmed here. This species occurs with its similar congener, *V. phillipi*, in southern New South Wales and Victoria.

Present data show that most collections are from estuarine or inshore areas in 0.5-10 m over sand, small rocks or rubble, and among "weed" or *Zostera* sp.

Material examined: Sixty-seven specimens, 21.5-152 mm SL, including one syntype.

Syntype: ZMB 5035, formerly Hamburg Mus. (130.5, adult male), Sydney, N.S.W.

Other material: Australia, Qld.: AMS I.22528-001 (1, 59.5). N.S.W.: AMS I.16502-002 (2, 97-110), AMS I.16799-011 (3, 104.5-142), AMS I.17895-003 (2, 127-129), AMS I.19126-001 (2, 129.5-132.5), AMS I.19360-002 (1, 132.5), AMS I.19901-003 (2, 133.5-144), AMS IB.2589 (2, 139.5-152), GCRL 16337 (1, 131), GCRL 16454 (7, 129-147), GCRL 16975 (1, 131), GCRL 17497 (1, 109.5), GCRL 19039 (2, 119-124.5), GCRL 19040 (6, 91.5-133), GCRL 19041 (7, 88.5-146.5), GCRL 19149 (1, 72), GCRL 19150 (11, 104-136), USNM 148617 (1, 97), USNM 215318 (1, 129). Vic.: AMS I.19777-007 (1, 85.5), AMS uncat. (1, 109.5), GCRL 16450 (4, 94-139.5), NMV A.660 (1, 125), NMV A.663 (1, 120), NMV A.693 (1, 70), NMV A.695 (1, 91.5). W.A.: GCRL 16458 (1, 126), GCRL 16462 (1, 21.5).

***Vanacampus phillipi* (Lucas)**

Plate 3

SYNOPSIS OF AUSTRALIAN PIPEFISHES

Table 7. Frequency distributions of subdorsal tail rings in Australian species of *Parasyngnathus*, *Vanacampus*, *Pugnaso*, *Kaupus*, *Mitotichthys* and *Histiogamphelus*.

Genus Species	Subdorsal tail rings									
	1.25	2.00	2.75	3.50	4.25	5.00	5.75	6.50	7.25	
<i>Parasyngnathus</i>										
<i>penicillus</i>						4	64	12		
<i>parvicarinatus</i>						4	10*			
<i>Vanacampus</i>										
<i>vercoi</i>					10	10*				
<i>phillipi</i>					2	73	102	30		
<i>margaritifer</i>				13	41	12				
<i>poecilolaemus</i>						2	34*	14		
<i>Pugnaso</i>										
<i>curtirostris</i>				15*	97	15				
<i>Kaupus</i>										
<i>costatus</i>			13	23*	4					
<i>Mitotichthys</i>										
<i>tuckeri</i>	1	5*	4	1						
<i>semistriatus</i>								15*	20	
<i>meraculus</i>					2*					
<i>mollisoni</i> ¹										1*
<i>Histiogamphelus</i>										
<i>briggsii</i>		2*	26	9						
<i>cristatus</i>	3	6								

*Primary type.

¹Data from orig. descr.

?*Syngnathus* (sic) sp. Becker, 1857: 14, Figs. 1-3 (descr., notes on pouch larvae; Hobson's Bay, Vic.).

Syngnathus phillipi Lucas, 1891: 8, 12 (orig. descr.; Port Phillip Heads, Vic.); Duncker, 1909: 245 (characters, Albany, W.A. and Spencer's Gulf, S.A.); Waite and Hale, 1921: 295, 297, Fig. 40 (in key, synonym, descr., range); Munro, 1958: 83, Fig. 575 (characters, range); Scott, 1961: 58 (characters in key); Scott, 1962: 117, Fig. (characters, quite common in shallow weedy areas, range); Scott, 1963: 17, Fig. 5 (synonym, descr.; off Verona, Tas.); Scott, 1964: 85 (with *S. curtirostris*); Scott, 1968: 4, 6 (with *S. poecilolaemus*, *S. curtirostris* and *Lissocampus caudalis*; Kelso, Tas.); Scott, 1971: 123 (note on breeding season); Lenanton, 1974: 8, 14 (listed); Scott et al., 1974:

132, 134, Fig. (characters, range); Shiino, 1976: 110 (compiled); Scott, 1977: 124, 128 (descr., notes on brooding males, breeding season, depth of capture, etc.); Dawson, 1978b: 292 (name only); Glover, 1979: 150 (listed); Scott, 1979: 117 (synonym, on estuarine shores, food item of unidentified platycephalid); Scott, 1980: 106 (listed); Last et al., 1983: 298, 311, Fig. 27.23 (in key, descr., range).

Corythoichthys phillipi. McCulloch, 1911: 26, Fig. 10 (n. comb., counts, compared with *C. margaritifer*; Oyster Bay, Tas.); Scott, 1939: 141 (characters in key).

Syngnathus (*Parasyngnathus*) *phillipi*. Duncker 1915: 39, 82 (n. comb., descr., range).

Corythoichthys phillipi. Lord, 1923: 64 (emendation, listed); Lord and Scott, 1924: 39

Table 8. Frequency distributions of total subdorsal rings in Australian species of *Parasyngnathus*, *Vanacampus*, *Pugnaso*, *Kaupus*, *Mitotichthys* and *Histiogamphelus*.

Genus	Total subdorsal rings												
	Species	4.25	5.00	5.75	6.50	7.25	8.00	8.75	9.50	10.25	11.00	11.75	12.50
<i>Parasyngnathus</i>													
<i>penicillus</i>			4	64	12								
<i>parvicarinatus</i>			4	10*									
<i>Vanacampus</i>													
<i>vercoi</i>		7	13*										
<i>phillipi</i>				38	114	53	2						
<i>margaritifer</i>				30	36								
<i>poecilolaemus</i>					15*	32	3						
<i>Pugnaso</i>													
<i>curtirostris</i>		6*	97	24									
<i>Kaupus</i>													
<i>costatus</i>							13	26*	1				
<i>Mitotichthys</i>													
<i>tuckeri</i>										2	3	3*	3
<i>semistriatus</i>									13*	21	1		
<i>meraculus</i>						2*							
<i>mollisoni</i> ¹									1*				
<i>Histiogamphelus</i>													
<i>briggsii</i>					1*	18	18						
<i>cristatus</i>					2	7							

*Primary type.

¹Data from orig. descr.

(characters, Tas.); Lord, 1927: 13 (listed); McCulloch, 1929: 87 (compiled); Scott, 1939: 139, 143 (distr. note); Whitley, 1948b:14 (compiled).

Parasyngnathus phillipi. Whitley and Allan, 1958: 59 (n. comb., range); Whitley, 1964: 37 (listed).

Syngnathus philippi (sic). Kähnsbauer, 1978: 313 (characters).

Diagnosis: Trunk rings modally 18; tail rings 38-46; subdorsal tail rings 4.5-6.75 (usually 5.0 or more); HL averages 8.1 in SL; usually with a bar-like series of short pale lines or stripes on side of anterior tail rings.

Description: Rings 17-20 + 38-46, dorsal-fin rays 22-29, subdorsal rings 2.0-0.0 + 4.5-6.75 = 5.75-8.0, pectoral-fin rays 9-12 (modally 10-11), see Tables 1-8 for additional counts.

Proportional data, based on 96 specimens 56.5-135.0 (\bar{x} = 101.6) mm SL, follow: HL in SL 7.0-9.2 (8.1), snout length in HL 1.8-2.4 (2.1), snout depth in snout length 3.0-7.1 (5.5), length of dorsal-fin base in HL 1.1-1.6 (1.4), anal ring depth in HL 2.9-5.7 (3.9), trunk depth in HL 2.1-3.9 (2.9), pectoral-fin length in HL 4.8-8.6 (5.9).

Colouration: Upper half of head brownish or irregularly spotted, blotched or streaked with pale; lower half of opercle and venter of head usually pale in males, usually with irregular dark spots or streaks in females. Dorsum of body plain, mottled or streaked, sometimes with indications of 12-14 narrow pale bars. Side of trunk usually with dark-margined pale bars or blotches on upper and lower scutella of some or all rings, most often reduced to small spots posteriad, sometimes with longitudinal pale

Table 9. Geographic variation in frequencies of trunk, tail and total rings in *Parasyngnathus penicillatus*.

Locale	Trunk rings					Tail rings					Total rings							
	15	16	17	35	36	37	38	39	40	41	50	51	52	53	54	55	56	57
Kuwait	4				1	2	1					1	2	1				
Saudi Arabia	1			1							1							
India		3			3								3					
Thailand		4	1			1	4						1	3	1			
Indonesia	1	4			2	2	1					2	3					
Philippine Is.		2						2							2			
China		18	1			1	4	13	1					5	13	1		
Japan		70				10	38	21	1					10	38	21	1	
New Guinea	1	1					2							1	1			
Australia														1	2	2		
W.A.		5				1	2	2						1	2	2		
N.T.	1	7				1	5	1	1					1	5	2		
Qld.	5	54				11	27	19	2					14	26	17	2	
N.S.W.		4	1				5								4	1		

Table 10. Geographic variation in frequencies of dorsal- and pectoral-fin rays in *Parasyngnathus penicillatus*.

Locale	Dorsal-fin rays										Pectoral-fin rays							
	23	24	25	26	27	28	29	30	31	14	15	16	17	18				
Kuwait				1	2	1								5	2	1		
Saudi Arabia	1									1	1			1				
India						1	1			1	1			1	2			
Thailand			1	4	1						1			1	7	4		
Indonesia			1	3	1						1			1	4	1		
Philippine Is.			1											2				
China			2	1	6	7	2	2		3	23	6						
Japan				7	40	24	3			8	58	63	11					
New Guinea					1	1							4					
Australia																		
W.A.				1	2	2								8	2			
N.T.				2	3		2							6	6			
Qld.			1		18	29	11		1		10	63	35					
N.S.W.					1	2	3				3	7						

lines or streaks above the lateral ridge. Side of tail often with pale bars on anterior rings, usually with several narrow pale lines on each ring of anterior half or more of tail. Venter of trunk sometimes plain, often with irregular brown spots on anterior 3-4 rings, median ridge frequently brown; venter of tail plain, blotched or irregularly barred. Usually with 3-4 short brown bars on dorsal-fin rays, pectoral-fin rays shaded or edged with brown, caudal fin brown with pale margin.

Comparisons: This species is distinguished from congeners by characters in key and diagnosis. For further comparisons, see this section under *V. margaritifera*.

Remarks: Lucas (1891, p. 8) implied that "large numbers" of specimens were available for study and included measurements of two males and two females (99-121 mm TL) in the original description (p. 13). I have been unable to locate any of this material and it appears that the syntypes of *Syngnathus phillipi* are either lost or destroyed. Nevertheless, Lucas' counts of 18 + 40-44 rings, 25-26 dorsal-fin rays, 6 sub-dorsal tail rings and description of "whitish vertical bands" (e.g. pale bars) on the side, leave little doubt that his specimens were conspecific with material described here.

Among examined material, the brood pouch extends below 14-20 tail rings in 54 males (90.5-137 mm SL), pouch eggs are deposited in a single layer of two transverse rows in 14 brooding fish (93.5-137 mm SL), and total numbers of eggs range from 10 to 44.

Present data (Table 11) indicate some irregular geographic variation in frequencies of rings and dorsal- and pectoral-fin rays. Trunk rings are usually 18 in fish from New South Wales and Victoria but more variable (usually 18-19) in samples from South Australia and Tasmania, and numbers of tail rings are somewhat fewer in South Australian fish (38-43 versus 40-46 in other samples). Dorsal-fin rays are 24-27 in specimens from New South Wales, 22-26 in those from Victoria and South Australia, and 23-29 in Tasmanian material. Pectoral-fin rays are modally 10 in fish from New South Wales, Victoria and Tasmania, but 11 in samples from South Australia. These in-

consistent variations apparently represent local population differences rather than clinal variation.

Distribution: This species is known from southern New South Wales (Moruya Point) to Kangaroo I. and Spencer Gulf, South Australia, from Tasmania (south to Port Arthur), and from off Albany and Cottesloe, Western Australia. Collections are recorded from estuarine and coastal waters to depths of ca. 24 m over sand and "small rocks" and among "weed" and *Zostera* sp.

Material examined: Two hundred and twenty-three specimens, 50-184 mm SL. Australia, N.S.W.: GCRL 15504 (5, 100-124), GCRL 16336 (1, 105.5), GCRL 16366 (3, 82.5-117.5), GCRL 16342 (3, 98-103.5), GCRL 16343 (3, 78.5-121.5), GCRL 16344 (12, 70-123), GCRL 16345 (4, 51-81.5), GCRL 16346 (13, 56-110), GCRL 16347 (15, 61.5-122). Vic.: GCRL 16449 (9, 96-135), GCRL 16864 (1, 116), GCRL 17365 (4, 108.5-126.5), GCRL 17373 (3, 103.5-130.5), GCRL 17950 (1, 95.5), NMV A.554 (8, 73-92), NMV A.556 (1, 111), NMV A.658 (2, 108-117), NMV A.659 (1, ca. 115), NMV A.661 (2, 100-128), NMV A.669 (1, 108), NMV A.670 (3, 85.5-98), NMV A.678 (1, 107.5), NMV A.679 (2, ca. 95), NMV A.682 (1, 63), NMV A.688 (1, 88.5), NMV A.691 (1, 86), NMV A.692 (1, 82), NMV A.1989 (3, 121-123.5), USNM 217819 (3, 93-99.5). S.A.: AMS I.20160-030 (1, ca. 95.5), AMS I.20179-019 (1, 56.5), AMS I.20193-007 (3, 82-105), GCRL 14818 (2, 99.5-102.5), MCZ 52102 (2, 99-110.5), NMV A.667 (1, 137), SAM F.688 (2, 96.5-125), SAM F.1867 (1, 110.5), SAM F.1873 (1, 144), SAM F.2403 (26, 64-113.5), SAM F.2428 (1, 72), SAM F.2480 (1, 103), SAM F.3662 (1, 96.5), SAM F.3886 (66-111), SAM F.4155 (2, 71-75), USNM 216256 (1, 108). Tas.: AMS I.20749-002 (2, 108), AMS I.22529-002 (1, 85), GCRL 14796 (19, 68.5-124.5), GCRL 17036 (3, 91.5-101.5), QM I.16659 (1, 137), QVM 1972/5/180 (2, 116.5-119), WAM P.27550-001 (1, 184). W.A.: WAM P.6276 (1, 109.5), WAM P.26474-001 (1, 115).

***Vanacampus poecilolaemus* (Peters)**

Plate 4

Table 11. Geographic variation in frequencies of trunk rings, tail rings, and dorsal- and pectoral-fin rays in *Vanacampus phillipi*.

Locale	Trunk rings				Tail rings								
	17	18	19	20	38	39	40	41	42	43	44	45	46
N.S.W.	10	47	2					2	7	21	23	5	1
Vic.	4	26	7					1	6	13	13	4	
S.A.	6	32	22	5	1	9	18	21	10	6			
Tas.		18	10				1		9	6	5	6	1
W.A.		1		1				1	1				

Locale	Dorsal-fin rays								Pectoral-fin rays			
	22	23	24	25	26	27	28	29	9	10	11	12
N.S.W.			9	23	18	9			26	77	8	
Vic.	1	4	10	12	9				21	47	8	
S.A.	5	17	21	11	10					17	56	23
Tas.		2	8	4	8	4	1	1	15	30	5	2
W.A.				2							1	1

Syngnathus poecilolaemus Peters, 1869: 458 (orig. descr.; Adelaide, S.A.); Duméril, 1870: 550, 552 (in key, descr. compiled); Günther, 1870: 174 (descr. compiled); Castelnau, 1872a: 243 (listed); Macleay, 1882: 290 (descr. compiled); Zietz, 1908: 298 (Gulf St. Vincent and Spencer Gulf, S.A.); Waite and Hale, 1921: 295, Fig. 39 (synon., descr., S.A. and W.A.); Kähsbauer, 1950: 266 (characters); Munro, 1958: 83, Fig. 573 (characters, range); Scott, 1962: 117, 119, Fig. (in key, descr., moderately common); Scott, 1968: 4, 6 (descr.; Kelso, Tas.); Scott, 1970: 35 (ref.); Scott et al., 1974: 132, 134, Fig. (in key, descr., to 280 mm (TL), range); Scott, 1977: 135 (proportions, counts, Bass Strait); Dawson, 1978b: 292 (notes on synon.); Glover, 1979: 150 (listed); Scott, 1980: 106 (listed); Last et al., 1983: 298, 312, Fig. 27.24 (in key, descr., range).

Syngnathus paecilolaemus (sic). Castelnau, 1873: 78 (colour note).

Syngnathus modestus (not of Günther, 1870) Sauvage, 1879: 209 (orig. descr.; Noble I.,

Aust.); Duncker, 1909: 246 (possibly = *S. poecilolaemus*); McCulloch and Whitley, 1925: 137 (= *Corythoichthys poecilolaemus*); Whitley, 1929: 118 (preoccupied); Bertin and Estève, 1950: 47 (holotype listed); Dawson, 1978b: 291 (descr. of holotype).

Syngnathus poekilolaemus (sic). Duncker, 1909: 245 (characters; Barrow I., W.A.(?) and S.A.); Dawson, 1978b: 292 (name only).

Corythoichthys poecilolaemus. McCulloch, 1912: 82, Fig. 2 (n. comb.; descr.; Fremantle, W.A.); Scott, 1939: 141 (characters in key).

Syngnathus (Parasyngnathus) poecilolaemus. Duncker, 1915: 29, 82 (n. comb., descr., range).

Syngnathus (Parasyngnathus) modestus. Duncker, 1915: 28, 86 (n. comb., doubtful species, possibly = *S. poecilolaemus* or *S. phillipi*).

Corythoichthys poecilolaemus. McCulloch and Whitley, 1925: 137 (emendation, listed); Whitley, 1929: 118 (note); McCulloch, 1929: 87 (compiled); Dawson, 1978b: 292 (name only).

Corythoichthys sauvagei Whitley, 1929: 117 (replacement name for *Syngnathus modestus* Sauvage, preoccupied); McCulloch, 1929: 86 (compiled).

Parasyngnathus poecilolaemus. Whitley, 1948b: 14 (n. comb., listed); Whitley and Allan, 1958: 59, Fig. 16(1), (range); Whitley, 1964: 38 (listed).

Syngnathus sauvagei. Munro, 1958: 84 (n. comb., characters, Qld.); Dawson, 1978b: 291 (= *S. poecilolaemus*).

Parasyngnathus sauvagei. Whitley and Allan, 1958: 59 (n. comb., Qld.); Whitley, 1964: 37 (listed).

Syngnathus poecilolaemus (sic). Kähnsbauer, 1978: 313 (data from holotype, range).

Vanacampus poecilolaemus. Glover, 1983: 163 (n. comb., listed).

Diagnosis: Trunk rings modally 19; tail rings 44-51; subdorsal tail rings 5.0-6.75 (usually 5.5 or more); HL averages 7.3 in SL.

Description: Rings 18-20 + 44-51, dorsal-fin rays 25-31, subdorsal rings 1.75-0.5 + 5.0-6.75 = 6.25-8.0, pectoral-fin rays 11-14 (modally 12), see Tables 1-8 for additional counts. Proportional data, based on 31 specimens 54.0-261.0 (\bar{x} = 173.3) mm SL, follow: HL in SL 6.4-8.3 (7.3), snout length in HL 1.6-2.2 (1.8), snout depth in snout length 5.1-10.2 (8.4), length of dorsal-fin base in HL 1.3-1.8 (1.5), anal ring depth in HL 3.8-5.8 (4.7), trunk depth in HL 3.1-5.5 (3.8), pectoral-fin length in HL 7.0-9.5 (8.0).

Colouration: Dorsum and side of snout brownish with indistinct diagonal pale bars or blotches in adult males, venter of snout brownish, and venter of remainder of head and pectoral ring plain tan or pale. In adult females, snout barred or spotted with dark brown, with dark brown spots below eye, on lower half of opercle and on venter of pectoral ring. Dorsum of body largely brownish in both sexes; 6-9 irregular rows of small, dark-margined, ocelli on side of trunk; median ventral trunk ridge sometimes dark brown, elsewhere plain tan or brownish behind pectoral ring; lower part of subdorsal tail rings often with bar-like dark blotches on scutella, side of tail elsewhere

mainly plain; venter of tail plain or with irregular dark streaks. Dorsal-fin rays often with indications of 3-4 short dark bars, pectoral-fin rays edged or shaded with brown, and caudal fin brownish with pale margin.

Comparisons: This pipefish reaches a greater length than congeners (ca. 270 versus 184 mm SL), and is otherwise distinguishable by characters in the key and diagnosis.

Remarks: Peters' (1869) description, based on a single female specimen (157 mm TL), includes counts of 20 + 49 rings, 11 pectoral-fin rays, 3 anal-fin rays, and 1 + 6 subdorsal rings. The holotype (ZMB 5316) now lacks part of the tail and I count 19 trunk rings, 12 rays in the right pectoral fin and 11 in the left, 3 anal-fin rays, and 1 + 5.75 subdorsal rings. Rows of ocelli persist on the side of the trunk, scutella are brown on the anterior part of the tail, and there are brown spots under the eye and on the side of the snout.

The brood pouch extends below 17-21 tail rings in 15 males (170-230 mm SL), 5 brooding fish have pouch eggs deposited in a single layer of 2-4 transverse rows, and total numbers of eggs are 48 and 42 in two males (188.5 and 230 mm SL).

Present material shows no evidence of significant geographic variation.

Distribution: Known from Gulf St. Vincent, Spencer Gulf and Kangaroo I., South Australia, from Tasmania, and from Geographe Bay to Carnac I. (32°07'S), Western Australia. Locality records of Duncker (1909) from Barrow I., Western Australia (20°46'S), and of Sauvage (1879) from Noble I., Queensland (14°30'S) are questionable. This pipefish has been recorded from estuaries and shallow "weedy" bays (Scott, 1962), and from *Zostera* sp. (Scott, 1968). Present data include collections by trawl, seine and SCUBA in 1-11 m.

Material examined: Fifty-two specimens, 45.5-261 mm SL, including holotype.

Holotype: ZMB 5316 (damaged female, 149.5 mm overall length), Adelaide, S.A.

Other material: Australia, S.A.: AMS I.20179-017 (1, 107), AMS I.20189-023 (1,

180.5), GCRL 14816 (2, 188.5-233), NMV A.699 (3, 198.5-227), SAM F.687 (19, 143-261), SAM F.1763 (1, 259.5), SAM F.2490 (2, 117.5-249), SAM F.2617 (1, 211), SAM F.3587 (1, 77.5), SAM F.3633 (2, 54-94.5), SAM F.4677 (1, 175), SAM uncat. (2, ca. 114.5). Tas.: QVM 1972/5/743 (1, 181.5), TFDA uncat. (1, 176). W.A.: GCRL 16267 (7, 45.5-213.5), WAM P.5886 (1, 186), WAM P.21010 (1, 235), WAM P.26467-001 (1, 189), WAM uncat. (2, 109.5-125). Loc. questionable or uncertain: MNHN A.983 (94.5, holotype of *Syngnathus modestus*), Noble I., Australia, Castelnau col.

Pugnaso Whitley

Pugnaso Whitley, 1948c: 75 (type-species by original designation: *Syngnathus curtirostris* Castelnau, 1872).

Diagnosis: Median dorsal snout ridge low, not a high plate-like process extending above a horizontal through dorsal rim of orbit, usually terminating on anterior third of interorbital; supraopercular ridge absent; opercular ridge usually complete and angled posterodorsad toward gill opening in early juveniles, vestigial or absent in subadults-adults; other head ridges vestigial or absent; pectoral-fin base without distinct ridges; dorsum of trunk and tail flat to a little convex; principal body ridges low, often indistinct, superior trunk ridge not arched dorsad on subdorsal rings; scutella indistinct, without keel-like ridges; dorsal-fin origin on trunk, fin-base not elevated; trunk rings 17-19; total rings 59-63; dorsal-fin rays 21-25; total subdorsal rings 4.5-5.75; pectoral-fin rays 8-11; anal-fin rays 2-3; trunk depth of adult females little greater than that of adult males; pouch plates absent; pouch closure the semi type (Fig. 1).

Comparisons: The combination of semi pouch closure, absence of pouch plates, poorly defined body ridges, absence of supraopercular ridge and ridges on pectoral-fin base, together with absence of opercular ridge (in subadults-adults) as well as the absence of elevated snout ridge and dorsal-fin base distinguishes *Pugnaso* from other genera treated here.

Remarks: *Pugnaso* is closely related to

Vanacampus which shares the semi pouch closure and absence of well-developed pouch plates. However, young of *Pugnaso* have an arcuate opercular ridge, rather than the essentially straight ridge found in *Vanacampus*, and there are other seemingly significant differences in the development of head and body ridges. Pending further study, I treat *Pugnaso* as a monotypic endemic Australian genus.

Pugnaso curtirostris (Castelnau)

Figure 8, Plate 4

Syngnathus curtirostris Castelnau, 1872a: 243 (orig. descr.; St. Vincent's Gulf, S.A.); Macleay, 1882: 290 (descr.); Johnston, 1890: 37 (listed, Tas.); Zietz, 1908: 298 (dredged, Spencer Gulf); Duncker, 1909: 244 (characters); McCulloch and Waite, 1918: 39, pl. 5, fig. 1 (descr., fig. caption (p. 77) as "*curvirostris*"; Kangaroo I., S.A.); Waite and Hale, 1921: 293, 300, fig. 42 (descr.; St. Vincent's Gulf, Glenelg R., and Kangaroo I., S.A.); McCulloch, 1929: 86 (compiled); Mack, 1934: 179 (Hobson's Bay, Vic.); Scott, 1939: 141 (characters in key); Scott, 1942: 19 (characters in key, not known from Tas.); Whitley, 1948c: 75 (type-species of *Pugnaso*); Bertin and Estéve, 1950: 47 (presumptive holotype listed as "paratype"); Scott, 1953: 150 (descr.; Low Head, Tas.); Scott, 1955: 135 (characters in key); Munro, 1958: 82, fig. 569 (characters, Vic. and S.A.); Scott, 1961: 59, 62 (characters in key, synonym., notes on Tas. records); Scott, 1962: 117, fig. (in key, characters, range); Scott, 1964: 85 (proportional data, colour description, Tas.); Scott, 1966: 93 (descriptive data); Scott, 1968: 4, 6 (taken with *S. poecilolaemus*, *S. phillipi* and *Lissocampus caudalis*); Scott, 1970: 35 (ref.); Scott, 1971: 123 (note on breeding); Scott et al., 1974: 132, fig. (characters, range); Scott, 1977: 123 (compared with *S. caretta*, Tas.); Dawson, 1978b: 292 (data from holotype, compared with *S. caretta*); Glover, 1979: 150 (listed); Hutchins, 1979: 93 (listed); Scott, 1980: 106 (listed); Last et al., 1983: 298, 310, Fig. 27.21 (in key, descr., range).

Syngnathus modestus (not of Günther, 1870) Klunzinger, 1872: 44 (Port Philip, S.A.); Klunzinger, 1879: 419 (= *S. caretta*).

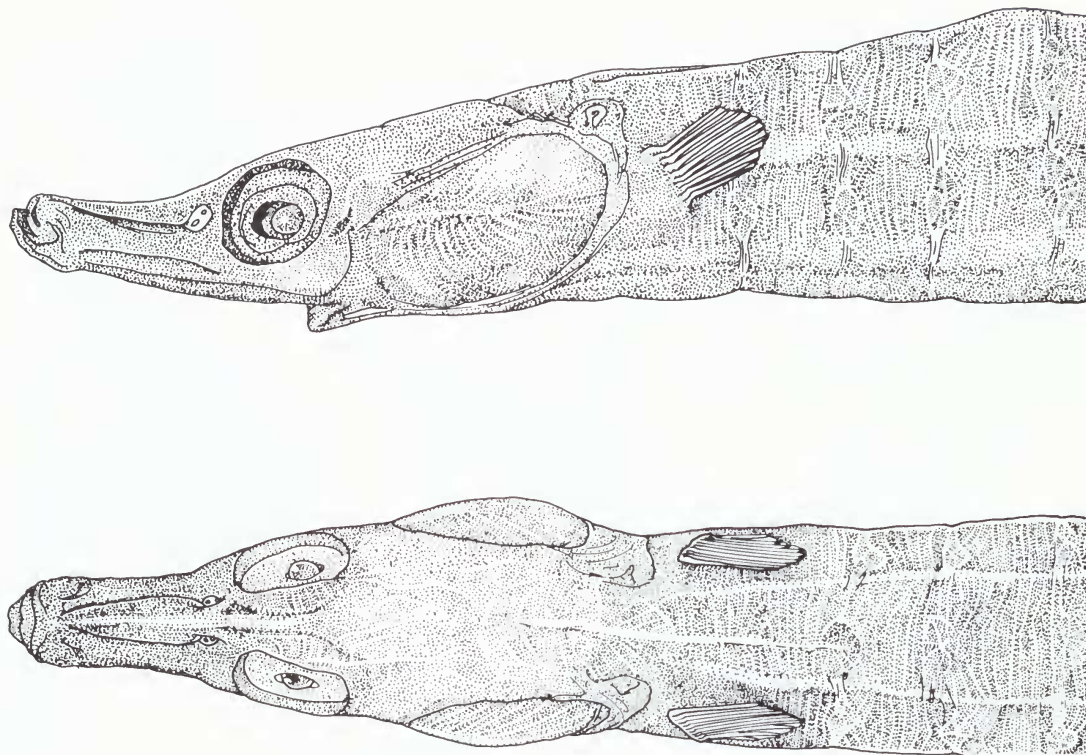


Figure 8. *Pugnaso curtirostris*. Lateral and dorsal aspects of head and anterior trunk rings. From adult female, 179 mm SL (GCRL 16266).

Synghathus (sic) *curtirostris*. Castelnau, 1873: 79 (descr.).

Syngnathus caretta Klunzinger, 1879: 419 [orig. descr.; Port Philip (S.A.)]; Macleay, 1884: 60 (descr. compiled); Lucas, 1890: 38 (compiled); Duncker, 1909: 244 (characters, possibly = *S. curtirostris*); Scott, 1977: 122 (synon., generic status, descr., comparisons; among *Zostera*; N. coast, Tas.); Dawson, 1978b: 291, fig. 1 (descr. of holotype, = *S. curtirostris*); Scott, 1980: 106 (listed).

Leptonotus caretta. McCulloch, 1928: 85 (n. comb., compiled); Scott, 1939: 141 (characters in key); Whitley, 1941: 16, fig. 12 (characters); Munro, 1958: 85, fig. 587 (characters, Vic.); Dawson, 1978b: 291 (name only).

Pugnaso curtirostris. Whitley, 1948c: 75 (n. comb.); Whitley and Allan, 1958: 59 (range);

Whitley, 1964: 37 (listed); Glover, 1983: 163 (listed).

Pugnaso caretta. Whitley and Allan, 1958: 59 (n. comb., Vic.); Whitley, 1964: 37 (listed); Dawson, 1978b: 292 (name only).

?*Syngnathus philippi* (sic). Kähsbauer, 1976: 286 (probable misident., Vic.).

Diagnosis: See that of genus.

Description: Rings 17-19+41-44, dorsal-fin rays 21-25, subdorsal rings 1.75-0.25+3.25-5.0=4.5-5.75, pectoral-fin rays 8-11 (modally 9), see Tables 1-8 for additional counts. Proportional data, based on 48 specimens 53.5-170.0 (\bar{x} =120.0) mm SL, follow: HL in SL 9.1-12.2 (11.1), snout length in HL 2.5-3.0 (2.7), snout depth in snout length 1.7-3.4 (2.9), length of dorsal-fin base in HL 1.1-1.6 (1.3), anal ring depth in HL 2.4-4.5 (3.1), trunk depth in HL 2.0-3.8 (2.7), pectoral-fin length in HL 4.2-6.5 (5.1).

Colouration: Colouration highly variable.

Some fish with a pale snout and a few irregular pale markings elsewhere on the head, a tan or light brown dorsum with 12-14 narrow bars between head and caudal fin, and with the body elsewhere largely dark brown. Others variegated throughout with tan, brown and pale. Most fish with spots or blotches on the head; dorsum of body, upper half of side of trunk and side of tail largely brown; lower half of side of trunk with more or less quadrate brown blotches on each ring, with a few pale spots on lateral ridge above and a dark-margined pale bar below which may continue on venter; venter of trunk usually pale or tan, plain or with short dark-margined pale bars on each ring near inferior ridges; venter of tail brownish, with or without irregular markings. Dorsal-fin rays with 3-4 short brown bars, membrane sometimes shaded with brown; caudal fin brown with pale distal margin.

Remarks: Castelnau (1872a) briefly diagnosed this species as having a dark brown colour with silvery spots on the head and anterior part of the body, and as having snout length 3 in HL. His later description (1873), based on a single specimen "a little over four inches and a half" long, included counts of 18+42 rings, 20 dorsal-fin rays, 0+5 subdorsal rings, and 6 caudal-fin rays. The presumptive holotype (MNHN A.982) has 44 tail rings, 23 dorsal-fin rays, 0.75+3.75 subdorsal rings, 10 rays in each pectoral fin and 10 caudal-fin rays. This female or immature male fish (now 116.5 mm SL) approximates the described length of the holotype. Its snout length is 2.7 in HL. Despite discrepancies in some meristic values, the specimen is conspecific with material described here, and there appears to be little doubt that it formed the basis for Castelnau's description.

The opercular ridge is often complete in specimens <50 mm SL, usually faint and incomplete at lengths of 50-100 mm SL, and is typically absent in larger fish.

The brood pouch extends below 9-18 (usually 15-17) tail rings in 25 males (119-182 mm SL) and the smallest examined brooding fish is 138.5 mm SL. Pouch eggs are usually in one layer and in 2-4 transverse rows. One male (138.5 mm SL) has two rows of 16 eggs throughout the 16-ring pouch, while another

(150 mm SL) has 4 rows of 22 eggs throughout 16 pouch rings.

Total rings number 60-63 (usually 61-62) in specimens from Victoria and Tasmania, whereas this count is 59-62 (usually 59-61) in fish from South Australia and Western Australia. Present data show no other evidence of geographic variation in meristic values.

Distribution: Known from Victoria (Port Phillip Bay and vicinity), South Australia (including Kergaroo I.), Northern Tasmania, and Western Australia (Flinders Bay to Rottneest I.). All collections are from inshore areas to depths of 11 m, and were made in tidepools, over sand and rocks, and among *Zostera* sp. and *Posidonia* sp.

Material examined: One hundred and twenty-five specimens, 25.5-182 mm SL, including presumptive holotype.

Presumptive Holotype: MNHN A.982 (116.5, female or juvenile male), Gulf St. Vincent, trawl, Waterhouse col.

Other material: Australia, Vic.: AMS I.19777-008 (3, 93.5-153), AMS I.19830-001 (1, 87), AMS I.19921-008 (2, 164.5-170), AMS I.21643-004 (2, 144-145), GCRL 17353 (1, 83.5), GCRL 17354 (1, 101.5), GCRL 17372 (4, 96-146.5), NMV A.233 (1, ca. 102), NMV A.662 (1, 151), NMV A.677 (2, 118-146), NMV A.1988 (2, 138-139), SMNS 1810 (105, juvenile, holotype of *Syngnathus caretta*). S.A.: AMS I.17615-006 (3, 47.5-71.5), AMS I.20160-029 (1, 82), AMS I.20162-007 (10, 63-140), AMS I.20171-010 (1, 82.5), AMS I.20180-019 (5, 107.5-142.5), AMS I.20183-002 (7, 41-92.5), AMS I.20189-022 (1, 130.5), GCRL 14817 (1, 147.5), MCZ 52107 (1, 135), SAM F.691 (71, juvenile, paratype of *S. vercoi*), SAM F.692 (1, ca. 137), SAM F.3180 (1, 101.5), SAM F.3631 (6, 45.5-153), SAM F.3919 (9, 25.5-81.5), SAM F.3921 (1, 83), SAM F.3922 (1, 33.5), SAM F.4156 (1, 77). Tas.: GCRL 14797 (20, 115.5-152), QVM 1972/5/527 (8, 85-138.5), QVM 1976/5/157 (1, 100.5), QVM 1976/5/159 (3, 75-80), TFDA uncat. (2, 87-152), USNM 217817 (1, 77), USNM 217818 (4, 56-138), WAM P.27562-003 (2, 57-57.5). W.A.: GCRL 16266 (4, 144.5-182), QM I.13456 (1, 94), WAM P.24431-3 (3, 70-105.5), WAM

P.25702-001 (1, 46), WAM P.25752-005 (1, 141.5), WAM P.25761-006 (1, 142.5).

Kaupus Whitley

Kaupus Whitley, 1951b: 392 (as subgenus of *Leptonotus* Kaup; type-species by original designation: *Leptonotus costatus* Waite and Hale, 1921).

Diagnosis: Median dorsal snout ridge low, not a high plate-like process extending above horizontal through dorsal rim of orbit, confluent behind with anterior continuations of supraorbital ridges; opercular ridge straight, crosses half or more of opercle in subadults-adults; other head ridges distinct but not elevated strongly; with or without prominent ridges on pectoral-fin base; dorsum of body flat to a little depressed between superior ridges; principal body ridges distinct, superior trunk ridge not arched dorsad on subdorsal rings; scutella without longitudinal keel-like ridges; dorsal-fin origin on trunk, fin-base not elevated; trunk rings 16-18; total rings 51-56; dorsal-fin rays 30-36; total subdorsal rings 8.0-9.25; pectoral-fin rays 9-11; anal-fin rays 3-4; trunk depth of adult females much greater than that of adult males; pouch plates present; pouch closure the everted type (Fig. 1).

Comparisons: The combination of a prominent opercular ridge, 9-11 pectoral-fin rays, an exceptionally deep trunk in adult females, presence of pouch plates and everted pouch closure, together with absence of elevated snout ridge and dorsal-fin base distinguishes *Kaupus* from other genera treated here.

Remarks: *Kaupus* and its type-species, *Leptonotus costatus*, have usually been referred to *Leptonotus* Kaup 1853, but *Kaupus* lacks the confluent lateral trunk and tail ridges characteristic of that genus (Fig. 2a). *Kaupus* further differs in having the median dorsal snout ridge confluent with the supraorbital ridges (snout ridge ends on interorbital in *Leptonotus*), and in having well-developed pouch plates and a prominent ridge on the opercle (both absent in *Leptonotus*). These differences are sufficient for recognition of *Kaupus* as a monotypic endemic Australian genus.

Kaupus costatus (Waite and Hale)

Figure 9, Plate 5

Leptonotus costatus Waite and Hale, 1921: 301, fig. 43 (orig. descr.; Spencer Gulf, S.A.); McCulloch, 1929: 85 (compiled); Scott, 1939: 141 (characters in key); Whitley, 1951b: 392 (type-species of *Kaupus*); Munro, 1958: 85, fig. 588 (characters); Scott, 1962: 116, fig. (in key, characters); Scott et al., 1974: 136, fig. (in key, characters); Glover, 1976: 171 (compiled); Scott, 1977: 123 (nomenclatural note); Glover, 1979: 147, 150, fig. 7i (among vegetation; Kangaroo I., S.A.).

Leptonotus (Kaupus) costatus. Whitley, 1951b: 392 (n. comb.; comparisons); Whitley and Allan, 1958: 59 (listed); Whitley, 1964: 37 (listed).

Kampus (sic) *costatus*. Coleman, 1980: 87, col. pl. (n. comb., ecol. notes).

Kaupus costatus. Dawson, 1982: 11, 40 (note on brood pouch, comparisons); Last et al., 1983: 298, 302, Fig. 27.9 (in key, descr., range, in part).

Diagnosis: See that of genus.

Description: Rings 16-18 + 35-38, dorsal-fin rays 30-36, subdorsal rings 5.75-4.25 + 2.5-4.5 = 8.0-9.25, pectoral-fin rays 9-11 (modally 10), see Tables 1-8 for additional counts. Proportional data, based on 22 specimens 43.5-127.0 (\bar{x} = 74.3) mm SL, follow: HL in SL 7.8-9.8 (8.7), snout length in HL 2.5-3.1 (2.8), snout depth in snout length 1.8-3.1 (2.3), length of dorsal-fin base in HL 0.7-0.9 (0.8), anal ring depth in HL 3.0-4.4 (3.9), pectoral-fin length in HL 4.0-5.5 (4.5). Trunk depth in HL in mature males 2.3-2.9 (based on 4, 87.5-127 mm SL), in mature females 1.1-1.5 (based on 3, 106-115 mm SL).

Colouration: Adult males and subadults tan to brownish, sometimes with a narrow, near-black, midlateral stripe on anterior half or more of tail. Adult females sometimes with a pale stripe on opercular ridge, with brown streaks, bars and small ocelli above lateral trunk ridge, and with prominent brown bars (blue in life) below lateral ridge on each trunk ring; dorsum brownish shading to pale distally;

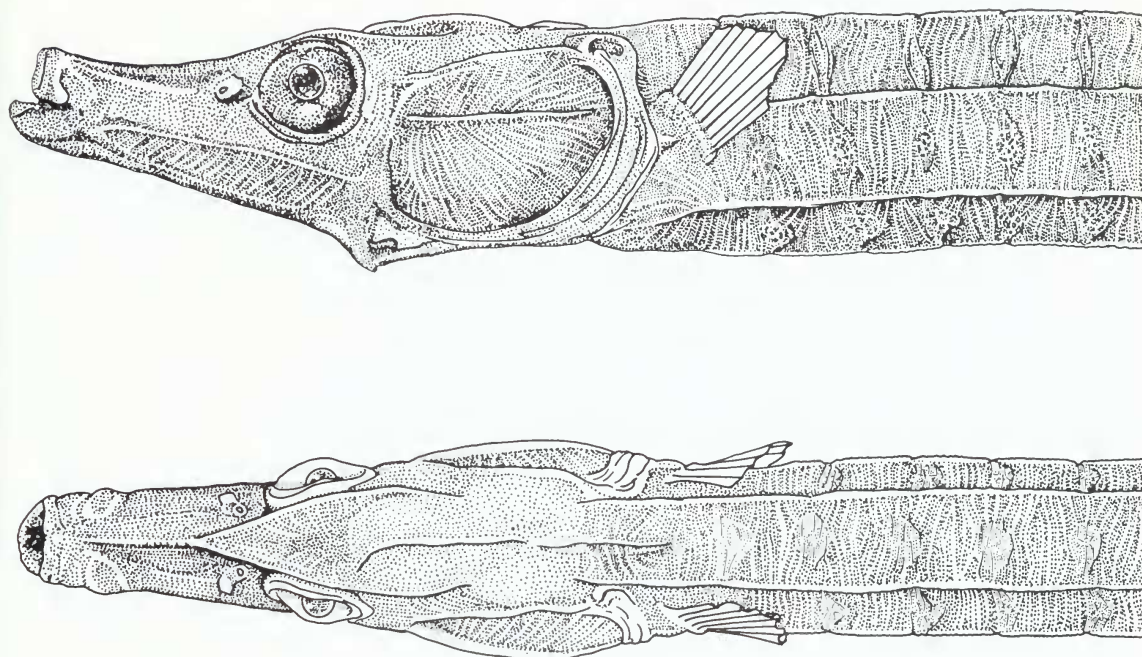


Figure 9. *Kaupus costatus*. Lateral and dorsal aspects of head and anterior trunk rings. From adult male, 87.5 mm SL (AMS I.20177-012).

venter mainly pale throughout; fins shaded lightly with brown.

Remarks: The holotype (SAM F.693) is now faded in preservative, the dorsal and pectoral fins are damaged and the caudal-fin rays cannot be counted accurately. Although not listed as paratypes by Glover (1976), seven specimens (SAM F.695) collected by P. Geisler in Gulf St. Vincent and discussed by Waite and Hale (1921), should also be considered paratypes. I have examined the smallest specimen in this lot (67.5 mm SL). The remaining paratype (SAM F.694) is now damaged and in very poor condition.

Frequency of caudal-fin rays is a stable character in most genera of pipefishes and numbers of fin-rays are typically 8, 9, 10 or 11 in non-regenerated specimens. Among 37 specimens of *K. costatus*, without evidence of tail regeneration, caudal-fin rays number 7 (in 2), 8 (3), 9 (17), 10 (15). These limited data suggest that, unlike other pipefishes, frequency of caudal-fin rays is variable in this species.

An immature male (72 mm SL) has traces of developing pouch folds under 11 tail rings and 7 mature fish (86.5-127 mm SL) have the brood pouch developed below 12-14 rings. Pouch eggs are deposited in one layer and in 2-4 transverse rows, and occasional specimens have the pouch folds fused on the 2-3 distal pouch rings. One male (97 mm SL) has a total of 17 pouch eggs deposited in two rows through 11 of 13 pouch rings and another (113.5 mm SL) has ca. 52 eggs in four rows in the 13-ring pouch. Near term brood-pouch young are 12-15 mm TL.

Present materials show no evidence of geographic variation.

Distribution: Known from Bruthen Creek, Victoria (146°50'E), from South Australia (including Kangaroo I.), and from Flinders I., Tasmania. Coleman (1980) notes occurrence over seagrass and algal beds in depths of 1-50 m. Present records include one seine collection in 0-3 m.

Material examined: Forty-one specimens, 18.5-129 mm SL, including holotype and two paratypes.

Holotype: SAM F.693 (115.0, adult female),

Spencer Gulf, S.A., dredged, 7 Dec. 1920, J. Verco.

Paratypes: SAM F.694 (damaged female), taken with holotype. SAM F.695 (1, 67.5), Gulf St. Vincent, S.A., 1920, P. Geisler.

Other material: Australia, Vic.: AMS I.21407-002 (1, 72). S.A.: AMS I.20177-012 (6, 28.5-87.5), AMS I.20178-009 (5, 18.5-79), AMS I. 20179-018 (1, 66.5), AMS I.20184-003 (4, 103.5-127), GCRL 14819 (2, 54.5-56.5), GCRL 16275 (2, 70-97), NMV A.301 (1, 85.5), NMV A.302 (1, 113.5), NMV uncat. (1, 129), SAM F.3296 (1, 61.5), SAM F.3920 (4, 42-60.5), SAM F.3923 (1, 90.5), SAM F.4165 (6, 39-107). Tas.: TFDA uncat. (2, 74.5-96.5).

Mitotichthys Whitley

Mitotichthys Whitley, 1948c: 75 (type-species by original designation: *Syngnathus tuckeri* Scott, 1942).

Diagnosis: Median dorsal snout ridge low, not a high plate-like process extending above horizontal through dorsal rim of orbit, usually terminating on anterior half of interorbital; supraopercular ridge absent; opercular ridge typically vestigial or absent in subadults-adults, sometimes persistent on anterior third of opercle; other head ridges low or obsolete; usually without well-developed ridges on pectoral-fin base; dorsum of trunk a little convex, sloped upward on subdorsal rings; dorsum of tail convex to a little depressed between superior ridges; superior trunk ridge arched a little dorsad on subdorsal rings; scutella without keel-like ridges; dorsal-fin origin on trunk, anterior half or more of fin-base elevated; trunk rings 19-23, total rings 54-70; dorsal-fin rays 25-40; total subdorsal rings 7.0-12.75; pectoral-fin rays 10-14 (except 18 in *M. mollisoni*); anal-fin rays 2-4; trunk depth of adult females somewhat greater than that of adult males; pouch plates absent or vestigial; pouch closure the everted type (Fig. 1) though unknown in *M. meraculus* and *M. mollisoni*.

Comparisons: The combination of 19-23 trunk rings, absence of well-developed opercular ridge and absence of an elevated snout ridge, together with presence of an elevated dorsal-fin

base and everted pouch closure, distinguishes *Mitotichthys* from other treated genera.

Remarks: This endemic Australian genus is here considered to include four species. However, two (*M. meraculus*, *M. mollisoni*) are known from a total of three specimens, and their referral to *Mitotichthys* is provisional.

Although brood-pouch plates are usually absent, vestiges of plates were observed concealed within the dorsal margins of the rather fleshy pouch folds of some specimens of *M. tuckeri* and *M. semistriatus*.

KEY TO THE SPECIES OF *MITOTICHTHYS*

- 1a. Dorsal-fin rays 25-28 2
- 1b. Dorsal-fin rays 35-40 3
- 2a. Tail rings 34-35; pectoral-fin rays 13
..... *meraculus*
- 2b. Tail rings 44; pectoral-fin rays 18 *mollisoni*
- 3a. Subdorsal trunk rings 10.0-7.5; tail rings 40-43 *tuckeri*
- 3b. Subdorsal trunk rings 4.0-2.75; tail rings 46-50 *semistriatus*

Mitotichthys tuckeri (Scott)

Figure 10, Plate 6

Syngnathus tuckeri Scott, 1942: 17, pl. 5, figs. 1-3 (orig. descr.; Bridport, Tas.); Whitley, 1948c: 75 (type-species of *Mitotichthys*); Scott, 1955: 135 (characters in key); Munro, 1958: 82, fig. 568 (characters); Scott, 1961: 59 (characters in key); Scott, 1964: 93 (synon., descr., comparisons with *S. curtirostris*); Green, 1974: 4 (compiled); Dawson, 1978c: 417, fig. 3 (descr.; Twofold Bay, N.S.W.); Kähnsbauer, 1978: 314 (counts, N.S.W.); Scott, 1980: 106 (listed); Last et al. 1983: 298, 313, Fig. 27.25 (in key, descr., range).

Mitotichthys tuckeri. Whitley, 1948c: 75 (n. comb., type-species of *Mitotichthys*); Whitley and Allan, 1958: 59 (listed); Scott, 1960: 87 (synon., descr.); Whitley, 1964: 37 (listed); Scott, 1971: 123 (note on breeding season); Scott, 1975: 134 (synon., notes on generic status and breeding season).

Diagnosis: Subdorsal tail rings <4; dorsal-fin rays 35-38; pectoral-fin rays usually 11.

Description: Rings 21-23 + 40-42, dorsal-fin rays 35-38, subdorsal rings 10.0-7.5 +

1.5-3.25 = 10.0-12.75, pectoral-fin rays 10-12, see Tables 1-8 for additional counts. Proportional data, based on 9 specimens 76.0-159.0 (\bar{x} = 128.1) mm SL, follow: HL in SL 6.5-7.9 (7.3), snout length in HL 1.8-2.1 (1.9), snout depth in snout length 4.6-7.2 (5.9), length of dorsal-fin base in HL 0.9-1.2 (1.0), anal ring depth in HL 5.0-6.6 (5.6), pectoral-fin length in HL 4.1-5.8 (4.7). Trunk depth in HL in mature males 4.0-5.2 (4, 121.5-133.5 mm SL), in mature females 2.8-3.7 (3, 149.5-159 mm SL).

Colouration: Tan, without distinctive markings. Head and body irregularly shaded with brownish microchromatophores, somewhat darker on dorsum and upper part of side; dorsal and pectoral fins hyaline or sprinkled with microchromatophores; caudal fin brownish, shading to dark brown distally.

Comparisons: See key and diagnosis. This species is perhaps most similar to *M. semistriatus* from which it is readily distinguished by the more anterior dorsal-fin origin (on 10-7.5 trunk rings versus 4-2.75 in *M. semistriatus*), and absence of prominent markings on head and body (present in *M. semistriatus*).

Remarks: Some discrepancies in the original description have been noted previously (Dawson, 1978c), and present ranges for meristic features reflect data of Scott (1960, 1964) for four specimens that I have not examined.

Among present material, the brood pouch extends below 11-12 tail rings in four males (99-149 mm SL), and pouch eggs are deposited in a single layer of 3-6 transverse rows. One fish (131.5 mm SL) has ca. 100 eggs arranged in three rows through 9 of 11 pouch rings.

Present materials show no evidence of significant geographic variation.

Distribution: Known from Twofold Bay, New South Wales and from Cam River Beach to Swansea, Tasmania. Although one sample was evidently trawled in 9.1-27.4 m, the holotype and most other specimens appear to be from "shallow water". As this species is poorly represented in collections, its ecological requirements are not known.

Material examined: Eleven specimens, 76-159 mm SL, including holotype.

Holotype: QVM 1971/5/28, orig. 1941.16 (121.5, brooding male), Bridport, Tas., G. V. Tucker col.

Other material: Australia, N.S.W.: CAS-SU 36427 (2, 133.5-159), CSIRO A.1645 (1, 149.5), CSIRO A.1646 (1, 126). Tas.: GCRL 17037 (3, 131.5-150.5), GCRL 17038 (1, 149.5), QVM 1975/5/110 (2, 76-99).

Mitotichthys semistriatus (Kaup)

Plate 7

Leptonotus semistriatus Kaup, 1853: 233 (nomen nudum); Kaup, 1856: 48 (orig. descr.; loc. unknown); Duméril, 1870: 582 (descr. compiled); Duncker, 1915: 89 (synon., descr.; S.A., Tas.); Lord, 1923: 64 (listed); Lord and Scott, 1924: 40 (fairly common, Tas.); Lord, 1927: 13 (listed); McCulloch, 1929: 85 (compiled); Mack, 1934: 180 (listed); Scott, 1939: 139, 141, 144, fig. 1 (characters in key, descr.); Scott, 1953: 149, fig. 3 (descr.); Munro, 1958: 85, fig. 589 (characters, range); Whitley and Allan, 1958: 59 (listed); Scott, 1961: 58 (characters in key); Scott, 1962: 116, fig. (in key, notes); Scott, 1963: 16, figs. 4a-b (descr., colour notes, to 267.5 mm SL); Whitley, 1964: 37 (listed); Scott et al., 1974: 136, fig. (in key, notes); Dawson, 1978b: 292 (name only); Fritzsche, 1980: 192 (compared with *L. blainvillianus*); Scott, 1980: 106 (listed); Develius, 1981: 320 (colour figs.); Last et al., 1983: 298, 303, Fig. 27.11 (in key, descr., range, in part).

Syngnathus verreauxianus Duméril, 1870: 568, 573 (in key, orig. descr., Tas.); Duncker, 1915: 89 (= *L. semistriatus*); Bertin and Estéve, 1950: 49 (holotype listed).

Syngnathus semifasciatus. Günther, 1870: 162 (n. comb., substitute name, descr.); Macleay, 1882: 288 (descr., range); Johnston, 1883: 134 (not uncommon, Tas.); Johnston, 1890: 37 (compiled); Lucas, 1890: 38 (listed); Duncker, 1909: 244 (characters, perhaps a local variety of *S. blainvillianus*); Waite, 1911: 174 (compared with *S. norae*); Duncker, 1915: 89

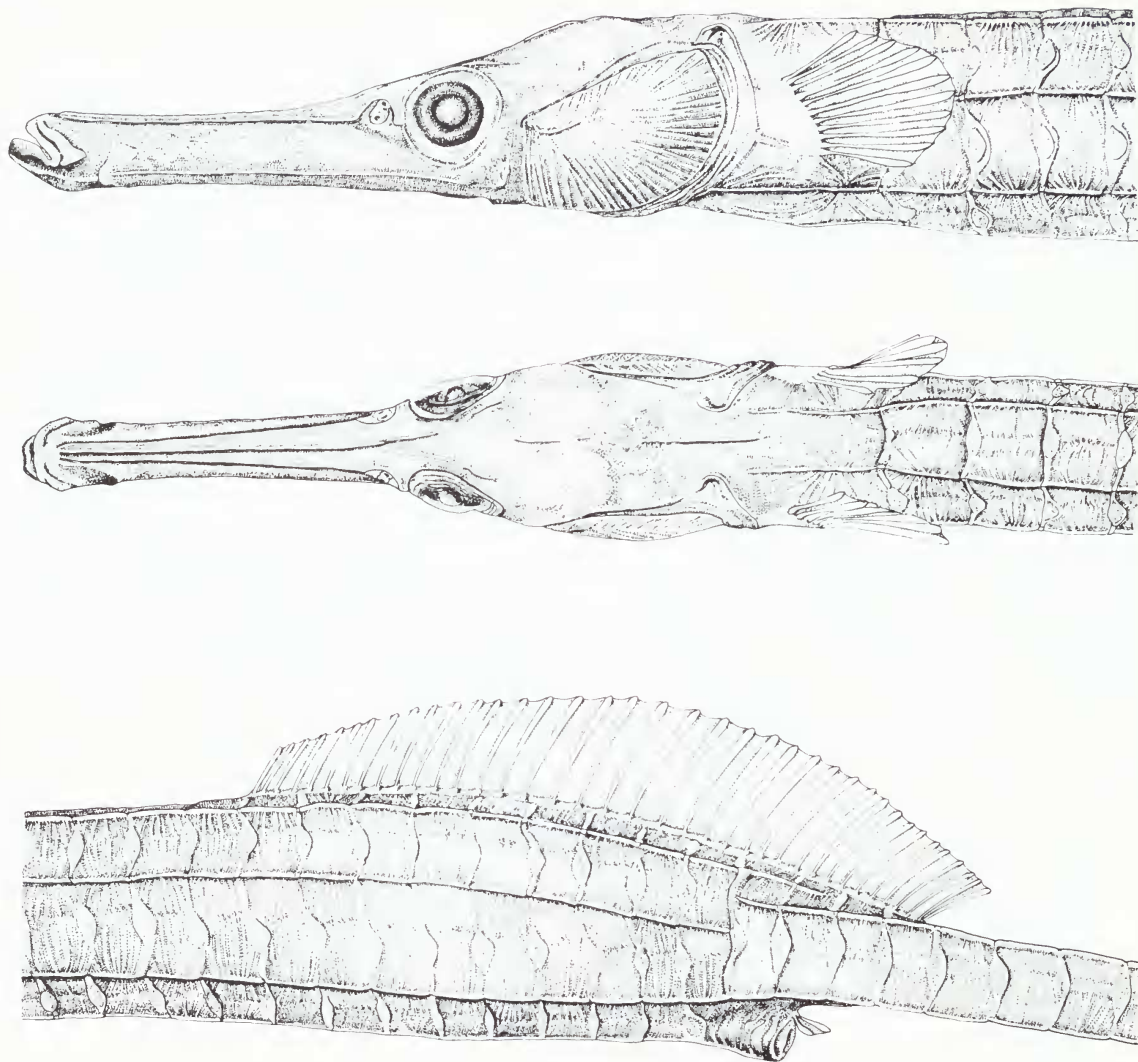


Figure 10. *Mitotichthys tuckeri*. Lateral and dorsal aspects of head and anterior trunk rings, together with lateral section of body illustrating configuration of principal ridges and fin positions. From adult female, 149.5 mm SL (GCRL 17038).

(= *Leptonotus semistriatus*); Dawson, 1978b: 292 (name only).

Syngnathus semistriatus. Castelnau, 1872b: 199 (n. comb., colour descr.); Waite, 1911: 174 (compared with *S. norae*); Fowler, 1907: 426 (incorrectly recorded from Fiji); Duncker,

1915: 89 (= *Leptonotus semistriatus*); Whitley, 1927: 4 (compiled from Fowler, 1907); Fowler, 1931: 324 (compiled from Whitley, 1927).

Syngnathus semi-fasciatus. Lucas, 1891: 9 (emendation, colour note).

Leptonotus tristriatus Fowler, 1922: 444, fig. 1 (orig. descr., "Fiji"; locality in error, probably Vic.); Herald, 1953: 231 (status uncertain); Fowler, 1959: 138 (synon., descr.).

Syngnathus tristriatus. Fowler, 1928: 113, fig. 24 (n. comb., characters).

Leptonotus semifasciatus. Scott, 1977: 123 (n. comb., name only).

Diagnosis: Subdorsal tail rings >4; dorsal-fin rays 36-40; pectoral-fin rays usually 13.

Description: Rings 19-20 + 46-50, dorsal-fin rays 36-40, subdorsal rings 4.0-2.75 + 6.25-7.5 = 9.25-10.75, pectoral-fin rays 12-14, see Tables 1-8 for additional data. Proportional data, based on 12 specimens 88.0-231.0 (\bar{x} = 135.9) mm SL, follow: HL in SL 6.6-7.3 (6.9), snout length in HL 1.6-1.9 (1.8), snout depth in snout length 6.1-10.9 (8.1), length of dorsal-fin base in HL 1.2-1.4 (1.3), anal ring depth in HL 5.0-6.9 (5.9), pectoral-fin length in HL 6.4-9.8 (7.9). Trunk depth in HL in mature males 4.5-5.5 (3, 139.5-160 mm SL), in mature females 2.8-4.2 (7, 141-184 mm SL).

Colouration: Dorsum of head and predorsal region of trunk pale to tan with an irregular median dark brown stripe from area above nares to the dorsal fin, where it divides to continue, bilaterally, along or around the fin-base; side of head with a broad brown stripe from near rear of gape to rear of opercle, with a dark-margined pale stripe below, and with the lower part of head shading from tan to pale ventrad; venter of trunk mainly pale; sides and dorsum of tail largely brown, venter brown to pale; dorsal- and pectoral-fin rays edged with brown; caudal fin brownish. Adult males with a pale stripe on pectoral-fin base, upper half of side of trunk dark brown with a few minute, dark-margined ocelli, and lower half of trunk pale or tan. Lateral trunk and tail ridges marked with a series of oval pale blotches and a few indistinct ocelli on side of tail. In some fish, the pale inferior ridge expands to a broad pale stripe along upper portion of brood pouch, and principal ridges are pale on the anterior half or more of tail. Mature females with several irregular rows of dark-margined ocelli in dark stripe above lateral trunk ridge, a narrow brown bar on lower part of side of each trunk ring, and lateral trunk and tail ridges sometimes pale. Most of these markings may fade with preservation, but the dark-margined pale stripe persists on the snout of most specimens examined.

Comparisons: See key, diagnosis, and this section under *M. tuckeri*.

Remarks: Kaup (1853, 1856) stated that the original locality of the holotype was unknown. Günther (1870) later noted that this specimen was labeled "South Australia," but this should probably be interpreted as southern Australia. Kaup (1856) described the holotype (BMNH 1980.9.11.1) as having 19 + 48 rings, 3 + 7 subdorsal rings, 38 dorsal-fin rays and 12 pectoral-fin rays. Some of these values are correct, but I find this fish to have 3 + 6.5 subdorsal rings, 13 rays in the left pectoral fin and 14 in the right. Furthermore, the lateral ridge configuration is anomalous on the left side, wherein the lateral tail ridge continues anterodorsad to unite with the superior trunk ridge near a vertical through dorsal-fin origin.

Although included in *Leptonotus* by Kaup (1856), this species lacks the confluent lateral trunk and tail ridges, characteristic of *Leptonotus* (Fig. 2a), and is referred to *Mitotichthys* owing to its agreement in diagnostic features and general morphology.

The brood pouch extends below 17-18 tail rings in four males (139.5-160 mm SL), the largest of which has 41 eggs in a single layer of ca. four transverse rows through 13 of 18 pouch rings.

Present materials show no evidence of significant geographic variation.

Distribution: Known from Port Phillip Bay and Westernport Bay, Victoria and from Tasmania (Woolnorth to Flinders I. and Port Arthur). The few useful data available indicate collections from among "seagrass" and "eelgrass" in depths of less than 10 m.

Material examined: Thirty-five specimens, 88-231 mm SL, including holotype.

Holotype: BMNH 1980.9.11.1 (231, adult female), loc. uncertain, probably southern Australia.

Other material: Australia, Vic.: AMS 1.19759-007 (1, 173), AMS 1.19785-001 (2, 88-93), AMS 1.19835-001 (3, 123.5-158.5), AMS 1.19921-007 (1, 175), AMS IA.2615 (5, 101-133), GCRL 16866 (3, 116-153), GCRL 17357 (5, 145.5-196), GCRL 17448 (1, 154), NMV A.553 (1, 139.5), NMV A.548 (1, 212), UM uncat. (3, 88-129.5). Tas.: AMS 1.22529-001 (2, 155.5-193.5), MNHN 6111

(115.5, female or juvenile male, holotype of *Syngnathus verreauxianus*). TFD: uncat. (5, 109.5-174).

Mitotichthys meraculus (Whitley)

Plate 7

Histiogamphelus meraculus Whitley, 1948a: 271 (orig. descr.; City Beach, near Perth, W.A.); Whitley, 1948b: 14 (listed); Whitley, 1955: 155, fig. 3 (holotype figured); Munro, 1958: 86, fig. 592 (characters); Whitley and Allan, 1958: 61 (listed); Anon., 1963: 35 (compiled); Whitley, 1964: 38 (listed); Whitley, 1966: 45, fig. (fig. only); Scott, 1980: 110 (name only).

Diagnosis: Subdorsal tail rings <4; dorsal-fin rays 25; pectoral-fin rays 13.

Description: Rings 20 + 34-35, dorsal-fin rays 25, subdorsal rings 4.0-3.75 + 3.25-3.5 = 7.0-7.5, pectoral-fin rays 13. Measurements (mm) from an adult female specimen (WAM P.25598) follow: SL 184.5, HL 23.3, snout length 12.4, snout depth 2.6, length of dorsal-fin base 17.3, anal ring depth 4.8, trunk depth 8.0.

Colouration: Ground colour of a somewhat faded adult female light brown; dorsal and pectoral fins hyaline; dorsum and venter of body and much of side of tail without persistent markings. Lateral scutella of each trunk ring with a small, dark-margined pale ocellus; each ring with a median vertical series of two additional ocelli above lateral trunk ridge and one below. Lower ocelli modified to form elongate pale bars on the 2-3 anterior tail rings. Two median caudal-fin rays brown to tips, remainder of fin brownish, margined above and below by a rather broad pale band.

Comparisons: In addition to characters in the key and diagnosis, this species differs from congeners in having the pectoral-fin base protruding slightly laterad, and the median dorsal snout ridge ending on the posterior half of the interorbital (usually on anterior half in congeners).

Remarks: This species is presently known only from the dried holotype (WAM P.1215) and the specimen described above. Relationships are

uncertain due to the lack of adequate material (especially adult males), but absence of an elevated, plate-like, median dorsal snout ridge dictates removal from the genus *Histiogamphelus*. Pending study of additional material, I provisionally refer *H. meraculus* to the genus *Mitotichthys*.

Distribution: Known only from the vicinity of Perth and from East Flinders Bay (near Augusta), Western Australia.

Material examined: Two specimens, ca. 184.5-222 mm SL, including holotype.

Holotype: WAM P.1215 (ca. 222, dried adult female), City Beach, near Perth, W.A., J. Kirk col.

Other material: Australia, W.A.: WAM P.25598 (1, 184.5).

Mitotichthys mollisoni (Scott)

Syngnathus mollisoni Scott, 1955: 131, fig. 2 (orig. descr.; Bivouac Bay, Tasman Peninsula, Tas.); Munro, 1958: 82, fig. 570 (characters); Scott, 1961: 58 (characters in key); Scott, 1968: 6 (listed); Scott, 1970: 35 (ref.); Green, 1974: 4 (holotype missing); Scott, 1980: 106 (listed); Last et al., 1983: 298, 311, Fig. 27.22 (in key, descr.).

Novacampus mollisoni. Whitley and Allan, 1958: 59 (n. comb., listed); Whitley, 1964: 38 (listed).

Diagnosis: Subdorsal tail rings >4; dorsal-fin rays 28; pectoral-fin rays 18.

Description: Rings 20 + 44, dorsal-fin rays 28, subdorsal rings 2.8 + 7 = 9.8, pectoral-fin rays 18, anal fin "minute," caudal-fin rays 6. Measurements (mm) of holotype follow: SL 159.2, HL 24.8, snout length 15.0, snout depth 2.3, trunk depth 5.1, pectoral-fin length 2.1.

Colouration: Brownish, without distinctive markings, except for a dark-margined pale stripe on side of snout and opercle.

Comparisons: See key and diagnosis.

Remarks: This species was described from a single female or immature male specimen which was entangled in a handline fished in 45.7 m. The holotype, reported missing by Green (1974), has not since been located and the pre-

sent information is based on the original description.

As noted in Remarks under *Kaupus costatus*, the presence of 6 caudal-fin rays is atypical in pipefishes, and suggests that the caudal fin was regenerated in the holotype of *Syngnathus mollisoni*. Thus, typical specimens may be expected to have 10 caudal-fin rays and a few more than 44 tail rings. In general morphology, this species appears most similar to *M. tuckeri* and *M. semistriatus*, and it shares the dark-margined, pale, lateral stripe on the head with *M. semistriatus*. *Mitotichthys mollisoni* and *M. semistriatus* overlap in numbers of trunk rings and subdorsal rings (Tables 1, 6-8) and overlap or agree closely in comparable proportional values, while the described number of tail rings of *M. mollisoni* is only two fewer than the minimum recorded for *M. semistriatus*. *Mitotichthys mollisoni* differs principally in having fewer dorsal-fin rays (28 versus 36-40 in *M. semistriatus*), and in having more pectoral-fin rays (18 versus 12-14 in *M. semistriatus*).

Status and relationships are uncertain, but, pending study of additional material (including adult males), this species is provisionally referred to *Mitotichthys* due to its general conformity with the generic diagnosis and apparent similarity with *M. tuckeri* and *M. semistriatus*. Whitley and Allan's (1958) referral of this species to *Novacampus* Whitley (a junior synonym of *Leptonotus*), characterized by confluent lateral trunk and tail ridges, is untenable.

Histiogamphelus McCulloch

Histiogamphelus McCulloch, 1914: 30 (type-species by original designation: *Histiogamphelus briggsii* McCulloch, 1914).

Diagnosis: Median dorsal snout ridge high, plate-like, its dorsal margin elevated to or above a horizontal through dorsal rim of orbit, terminating on interorbital or confluent with frontal ridge; supraopercular ridge vestigial or absent; opercle with a complete longitudinal ridge in juveniles (<40 mm SL), the ridge usually vestigial or obsolete in adults; dorsum of trunk flat to a little convex, usually sloped upward on subdorsal rings; dorsum of tail flat to a little depressed between superior ridges;

pectoral-fin base protruding a little laterad, usually with two low ridges; principal body ridges distinct, the superior trunk ridge usually arched a little dorsad on subdorsal rings; scutella without keel-like ridges; dorsal-fin origin on trunk, the anterior half or more of fin-base a little elevated; caudal fin usually lanceolate, the median rays a little longer than those above and below; trunk rings 18-22; total rings 47-58; dorsal-fin rays 23-28; total subdorsal rings 6.5-8.25; pectoral-fin rays 11-14; anal-fin rays 3-4; trunk depth of adult females somewhat greater than that of adult males; pouch plates rudimentary or absent; pouch closure the everted type (Fig. 1).

Comparisons: The high, plate-like, median dorsal snout ridge distinguishes *Histiogamphelus* from other genera treated here.

Remarks: The characteristic snout ridge is developed in small specimens (35-40 mm SL), which also have the posterior angles of the trunk rings and some tail rings elevated and produced to points. There is considerable intraspecific variation in the dorsolateral profile of the snout, but the snout ridge is high in all specimens examined. Pouch plates are absent in some males, but others have rudimentary plates, angled laterad from the vertical axis of the tail, obscured within the dorsal margins of the membranous pouch folds.

Relationships are presently uncertain, but *Histiogamphelus* appears to be most closely related to *Mitotichthys*. Although clearly differing in the morphology of the snout, these taxa lack a well-developed opercular ridge in subadults-adults, have relatively high numbers of trunk rings (18-23), and share the elevated dorsal-fin base and everted pouch closure.

Of the three species currently placed in the genus *Histiogamphelus*, I refer one (*H. meraculus* Whitley) to the genus *Mitotichthys* and I retain the remaining two endemic Australian species in *Histiogamphelus*.

KEY TO THE SPECIES OF *HISTIOGAMPHELUS*

- 1a. Tail rings 33-37; total rings 54-58; median dorsal snout ridge ending on interorbital, not confluent with frontal ridge *briggsii*

- 1b. Tail rings 28-31; total rings 47-51; median dorsal snout ridge not ending on interorbital, confluent with frontal ridge *cristatus*

***Histiogamphelus briggsii* McCulloch**

Figure 11, Plate 8

Histiogamphelus briggsii McCulloch, 1914: 30, fig. 4 (orig. descr., type-species of *Histiogamphelus*; Thouin or Wineglass Bay, Tas.); McCulloch, 1929: 92 (compiled); Mack, 1934: 180 (Gippsland Lakes, Vic.); Hale, 1939: 2 (compared with *H. maculatus*); Scott, 1939: 139 (characters in key); Whitley and Allan, 1958: 60, fig. 16-3 (listed); Whitley, 1964: 38 (listed); Scott, 1968: 6 (listed); Scott, 1980: 106 (synon., descr., discussion of sub-species); Last et al., 1983: 298, 301, Fig. 27.7 (in key, descr., range, in part).

Histiogamphelus briggsii. Duncker, 1915: 91 (emendation, descr. compiled); Lord, 1923: 64 (listed); Lord and Scott, 1924: 40 (characters); Lord, 1927: 13 (listed).

Histiogamphelus maculatus robensis Whitley, 1948c: 76 (orig. descr.; near Robe, S.A.); Munro, 1958: 86 (characters); Whitley and Allan, 1958: 61 (listed); Whitley, 1959: 310, fig. 2 (fig. only); Scott, 1962: 111, 113, fig. (in key, characters); Whitley, 1964: 38 (listed); Scott, 1974: 128, fig. (in key, characters); Glover, 1976: 171 (compiled); Scott, 1980: 110 (name only).

Histiogamphelus briggsii orae Whitley, 1950: 238 (orig. descr.; Thompson's Bay, Coogee, N.S.W.); Munro, 1958: 85 (characters); Whitley and Allan, 1958: 60 (listed); Whitley, 1964: 38 (listed); Scott, 1980: 107 (= *H. briggsii*).

Histiogamphelus briggsii briggsii. Munro, 1958: 85, fig. 590 (n. comb., characters); Scott, 1980: 107 (comparisons).

Diagnosis: Tail rings 33-37; median dorsal snout ridge ends on interorbital, rounded or emarginate in lateral profile of both sexes.

Description: Rings 20-22 + 33-37, dorsal-fin rays 24-28, subdorsal rings 5.5-4.0 + 2.0-3.5 = 6.75-8.25, pectoral-fin rays 11-14, see Tables 1-8 for additional counts. Proportional

data, based on 31 specimens 85.5-225.0 (\bar{x} = 142.9) mm SL, follow: HL in SL 7.6-10.5 (8.7), snout length in HL 1.8-2.6 (2.3), snout depth in snout length 1.7-2.7 (1.9), length of dorsal-fin base in HL 1.0-1.3 (1.1), anal ring depth in HL 3.2-4.5 (3.6), pectoral-fin length in HL 5.0-6.4 (5.4). Trunk depth in HL 1.7-2.2 in adult females (7, 127.5-225 mm SL), 3.0-3.3 in adult males (6, 123-173.5).

Colouration: Adult females tan to dark brown; head, dorsum and venter of body mainly plain. Side of trunk and anterior half or more of tail with irregularly arranged brown spots and dark-margined ocelli numbering 20 or more per ring; those above lateral trunk ridge mostly plain, those below usually smaller and mostly ocellate. In some fish, a few dark spots extend on side of head above the opercle and on dorsum of subdorsal rings. Adult males mainly brown, plain or with irregular pale streaks and blotches on side. Dorsum of body sometimes with 10-11 diffuse pale bars (ca. 1-2 rings wide) continuing ventrad on sides. Adults of both sexes often with tip of snout pale or light tan. Dorsal fin usually with an irregular, narrow, brown stripe along fin-base; fin otherwise often hyaline but fin-rays occasionally shaded with brown. Pectoral fin usually shaded with microchromatophores; caudal fin brown with a pale margin above and below the two median fin-rays. Young fish light tan to brown, tail often lighter or darker than head and trunk.

Comparisons: See key and diagnosis.

Remarks: The holotype of *H. briggsii* was described as having 36 tail rings, 23 dorsal-fin rays and 5 + 2 subdorsal rings, but I find these values to be 35, 24 and 4.75 + 2, respectively.

The descriptions of *H. m. robensis* (Whitley, 1948c) and *H. b. orae* (Whitley, 1950) are both based on single juvenile representatives of *H. briggsii*. These specimens were described as having 8 and 9 caudal-fin rays, respectively, but both have 10 rays. Furthermore, the holotype of *H. m. robensis* has 21 + 35 rings, 25 dorsal-fin rays and 5 + 2.75 subdorsal rings, rather than the described counts of 20 + 36, 24 and 4.5 + 3. Similarly, the holotype of *H. b. orae* has 13 rays in each pectoral fin and 5 + 2.75 sub-

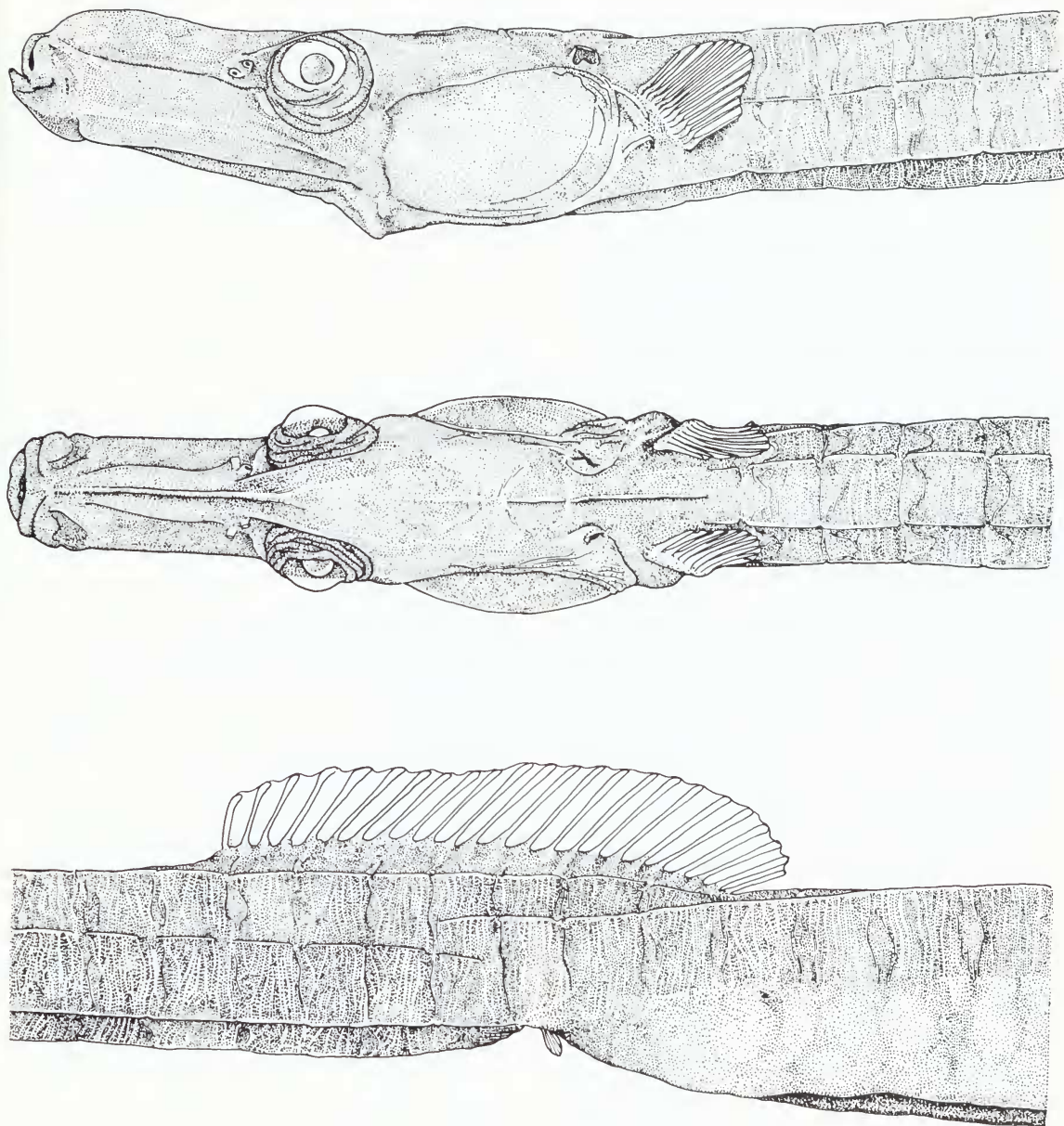


Figure 11. *Histiogamphelus briggsii*. Lateral and dorsal aspects of head and anterior trunk rings, together with lateral section of body illustrating configuration of principal ridges, fin positions, and anterior portion of brood pouch. From adult male, 135 mm SL (GCRL 16338).

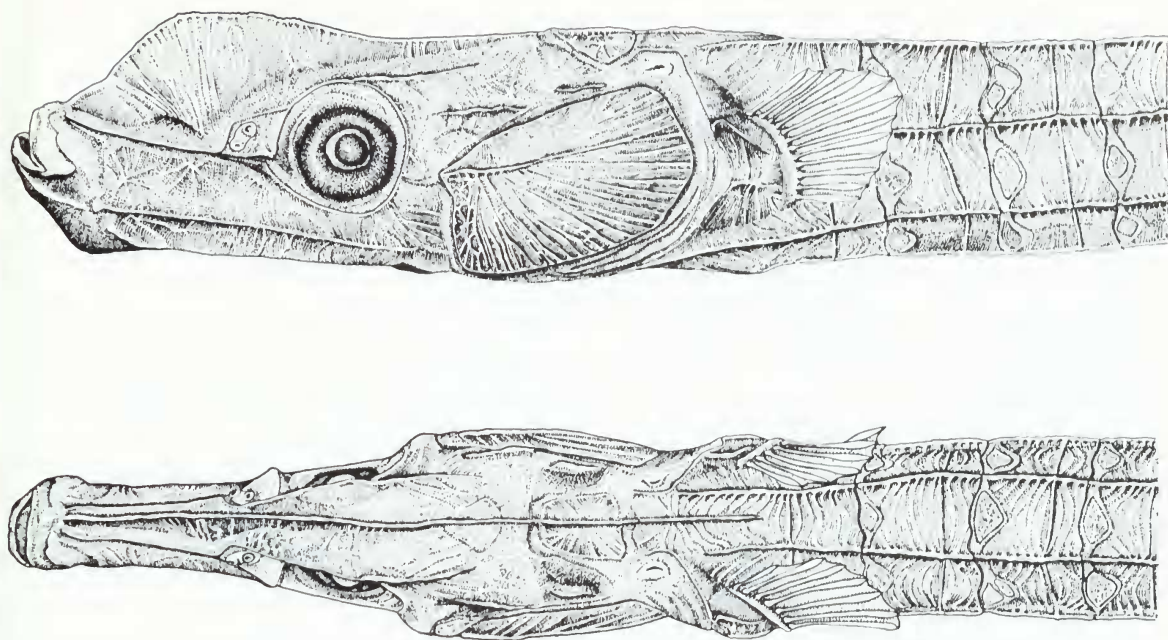


Figure 12. *Histiogamphelus cristatus*. Lateral and dorsal aspects of head and anterior trunk rings. From adult male, 136 mm SL (WAM P.25948-002).

Diagnosis: Tail rings 28-31; median dorsal snout ridge continuous through interorbital and confluent with frontal ridge; lateral profile of snout ridge usually angular in adult males, straight to somewhat rounded in females.

Description: Rings 18-20+28-31, dorsal-fin rays 23-26, subdorsal rings 6.0-5.0+1.25-2.0 = 6.5-7.5, pectoral-fin rays 11-13, see Tables 1-8 for additional counts. Proportional data, based on 7 specimens 133-187 (\bar{x} = 161.3) mm SL, follow: HL in SL 9.0-11.3 (9.9), snout length in HL 2.4-2.8 (2.6), snout depth in snout length 1.0-1.9 (1.2), length of dorsal-fin base in HL 0.9-1.2 (1.0), anal ring depth in HL 2.8-3.8 (3.4), pectoral-fin length in HL 4.7-6.4 (5.7). Trunk depth in HL 2.2 in one adult female (161 mm SL), 2.6-3.4 in 5 adult males (133-187 mm SL).

Colouration: Study material largely faded in preservative, but most specimens tan or brownish, some retain dark brown spots or streaks on median ventral trunk ridge. Males

plain or irregularly shaded and blotched with dark brown, most with anterior part of snout near-white. Two available adult females pale on anterior part of snout, remainder of head streaked or blotched with dark brown, most trunk rings with a prominent brown blotch above and below lateral ridge, tail generally lighter in colour than the head and trunk.

Comparisons: See key and diagnosis.

Remarks: As noted by Whitley (1948c), the holotype is now largely disintegrated and accurate counts or measurements cannot be obtained. Macleay (1882) described the holotype as having a high, sharp, ridge in front of the eye, 18+27 rings, 24 dorsal-fin rays, 5+2 subdorsal rings and a length of "four and a half inches" (ca. 110 mm TL). Even though the original description is brief and there is no figure, given characters permit little doubt that the holotype is conspecific with the other specimens treated here.

In juveniles and adult females (Pl. 9), the snout ridge is essentially straight or somewhat rounded in lateral profile, whereas the ridge is higher and more angular in most subadult-adult males. The description of *H. maculatus* (Hale,

dorsal rings, rather than the described values of 12 and 6 + 2.

Early juveniles (Pl. 8) have a relatively low snout ridge, the frontal, nuchal and prenuchal ridges are somewhat elevated, and the posterior angles of most rings are a little elevated and produced to sharp points. In subadults-adults, the snout ridge is higher, other median head ridges are low or vestigial, and the posterior angles of rings are neither elevated nor produced to points. Small fish (<40 mm SL) may have a complete ridge on the opercle. This ridge is usually less distinct and incomplete in specimens of moderate size (ca. 100 mm SL), and is typically vestigial or obsolete in larger fish (e.g. >130 mm SL).

The smallest examined male with evidence of a developing brood pouch is 90.5 mm SL, and the pouch is developed below 13-15 tail rings in 10 others (118-157.5 mm SL). Pouch eggs are deposited in 2-4 layers and in 2-6 transverse rows. One male (135 mm SL) has eggs deposited in 2 layers and 4 rows throughout the 15-ring pouch, and there are 28 eggs in the outer right row.

Present specimens do not show significant geographic variation in meristic values.

Distribution: Known from Sydney to Bermagui, New South Wales, from the Gippsland Lakes and southwestern Bass Strait, Victoria, from the vicinity of Robe, South Australia, and from Binalong Bay (Scott, 1980) and Wineglass Bay, Tasmania.

This species has been taken by a variety of methods and its preferred habitat is uncertain. The holotype and two other specimens were dredged in 16-27.4 m, and another was dredged "80 mi. (144 km) offshore". One male (129 mm SL) was taken in a plankton tow, and a number of juveniles and adults have been taken by divers in 3-20 m among "loose seaweed and floating dead *Zostera*" over fine sand bottom.

Material examined: Thirty-eight specimens, 35-225 mm SL, including holotype.

Holotype: TM D141/13022 (225, adult female), Wineglass Bay, Tas., dredge, 11 fms (20.1 m), 13 Apr. 1914, E. A. Briggs col.

Other material: Australia, N.S.W.: AMS I.18744-001 (2, 35-36.5), AMS I.18745-002 (1,

157.5), AMS I.18783-001 (1, 124), AMS I.19357-001 (11, 86.5-173.5), AMS IA.5631 (1, 109.5), AMS IB.84 (91, juvenile, holotype of *H. b. orae*), CSIRO A.1576 (1, 129), CSIRO A.3276 (1, 158), GCRL 16338 (12, 123-197.5), GCRL 16339 (2, 85.5-130), GCRL 17352 (1, 209.5). Vic.: NMV A.687 (1, 132.5), NMV A.2038 (1, 102). S.A.: SAM F.2611 (87.5, juvenile, holotype of *H. maculatus robensis*).

Histiogamphelus cristatus (Macleay)

Figure 12, Plate 9

Leptoichthys cristatus Macleay, 1882: 296 (orig. descr., W.A.); Stanbury, 1969: 206 (compiled).

Leptoichthys (?*Doryrhamphus*) *cristatus*. Duncker, 1909: 234 (n. comb., descr. compiled).

Histiogamphelus cristatus. McCulloch, 1913: 31 (n. comb., holotype "generally identical with *H. briggsii*"); Duncker, 1915: 92 (synon., descr. compiled); McCulloch, 1929: 92 (compiled); Whitley, 1948b: 14 (listed); Whitley, 1948c: 76 (compared with *H. meraculus*); Munro, 1958: 86 (characters); Whitley and Allan, 1958: 60 (listed); Whitley, 1964: 38 (listed); Scott, 1980: 110 (name only); Glover, 1983: 163 (listed).

Histiogamphelus maculatus Hale, 1939: 2, fig., col. pl. (orig. descr.; Aldinga Bay, Gulf of St. Vincent, S.A.); Whitley and Allan, 1958: 61 (listed); Whitley, 1964: 38 (listed).

Histiogamphelus gallinaceus Hale, 1941: 110, figs. (orig. descr.; Outer Harbour, Gulf St. Vincent, S.A.); Munro, 1958: 86, fig. 596 (characters); Whitley and Allan, 1958: 61 (listed); Scott, 1962: 111, fig. (in key, characters); Whitley, 1964: 38 (listed); Scott et al., 1974: 128, fig. (in key, characters); Glover, 1976: 171 (compiled); Scott, 1980: 110 (name only).

Histiogamphelus maculatus maculatus. Munro, 1958: 86, fig. 594 (n. comb., characters); Scott, 1962: 111, 113, fig. (in key, characters); Scott et al., 1974: 129, fig. (in key, characters); Glover, 1976: 171 (compiled); Glover, 1979: 150 (Kangaroo I., S.A.); Scott, 1980: 110 (name only).

1939) is based on an adult female with a slight emargination in the dorsal edge of the snout ridge, whereas the description of *H. gallinaceus* (Hale, 1941) is of an adult male with a high, angular, snout ridge. Although these fish and two others from South Australia have more tail rings than specimens from Western Australia (31 versus 28-29), there are no substantial differences among examined specimens and I consider *H. maculatus* and *H. gallinaceus* to be conspecific with *H. cristatus*.

The brood pouch extends below 11-14 rings in five adults (133-187 mm SL).

Distribution: Known from Gulf St. Vincent, Spencer Gulf and Kangaroo I., South Australia, and from the Recherche Archipelago, Geographe Bay, off Fremantle, and from Gage Roads (between Fremont and Rottne I.), Western Australia. Among the examined specimens, several were dredged, one subadult is recorded from 0-5 m, and one juvenile (39.5 mm SL) was taken from "weed beds."

Material examined: Ten specimens, 39.5-187 mm SL, including holotype.

Holotype: AMS I.16286-001, formerly Macleay Mus. F.256A (disintegrated), West Australia.

Other material: Australia, S.A.: AMS I.20180-018 (1, 158); SAM F.2039 (damaged, adult female, holotype of *H. maculatus*), SAM F.2227 (187, adult male, holotype of *H. gallinaceus*), SAM F.4430 (1, 170). W.A.: WAM P.21008 (1, 133), WAM P.21062 (1, 161), WAM P.25343-004 (1, 184), WAM P.25767-004 (1, 39.5), WAM P.25948-002 (1, 136).

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Explanation of Plates

PLATE 1

Parasyngnathus penicillus. Top—GCRL 18542 (female or juvenile male, 97.5 mm SL), Norman R., Qld. Middle—GCRL 15717 (adult male, 132 mm SL), Gulf of Siam. Bottom—GCRL 17583 (adult male, 141 mm SL), Oyodo R., Honshu I., Japan.

PLATE 2

Upper Pair—*Parasyngnathus parvicarinatus*; Darwin, N.T.: Upper—WAM P.25801-001 (adult male, holotype, 78.5 mm SL). Lower—GCRL 15644 (adult female, paratype, 70 mm SL). Lower Pair—*Vanacampus vercoi*. AMS I.20193-006 (adult male, 101.5 mm SL), Kangaroo I., S.A.

PLATE 3

Upper Pair—*Vanacampus margaritifera*; Sydney, N.S.W. (GCRL 16454): Upper—adult male, 140.5 mm SL. Lower—adult female, 139.5 mm SL. Lower Pair—*V. phillipi*; Port Phillip Bay, Vic. (GCRL 16449): Upper—adult male, 113 mm SL. Lower—adult female, 118 mm SL.

PLATE 4

Top—*Vanacampus poecilolaemus*. GCRL 16267 (adult female, 194 mm SL), Garden I., W.A. Middle and bottom—*Pugnaso curtirostris*. AMS I.21643-004 (adult female, 145 mm SL), Westernport Bay, Vic.

PLATE 5

Kaupus costatus; Kangaroo I., S.A. Top—GCRL 16274 (adult female, 106 mm SL). Bottom—GCRL 16275 (adult male, 97 mm SL).

PLATE 6

Mitotichthys tuckeri; Swansea, Tas. (GCRL 17037): Top and middle—adult female, 150.5 mm SL. Bottom—adult male, 132 mm SL.

PLATE 7

Top and middle—*Mitotichthys semistriatus*; Port Phillip

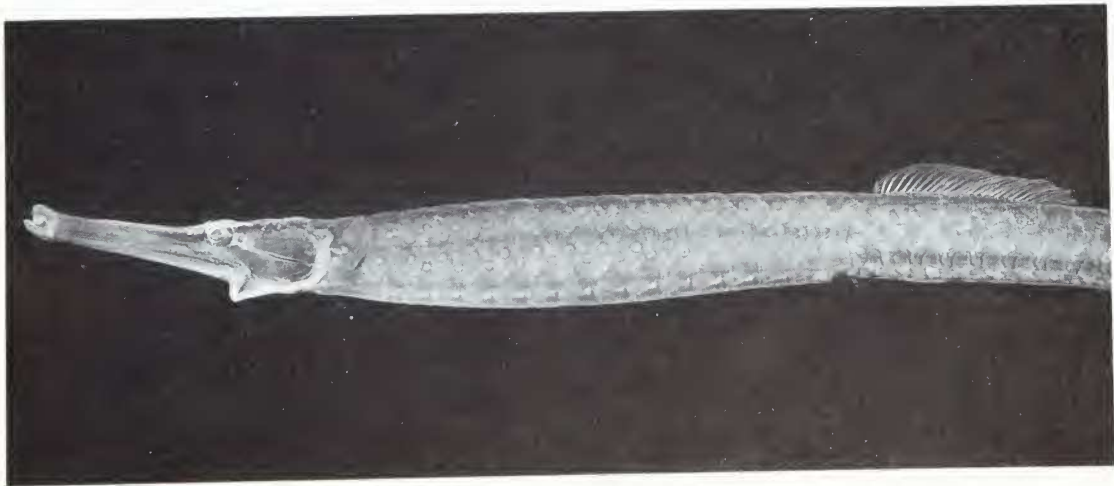
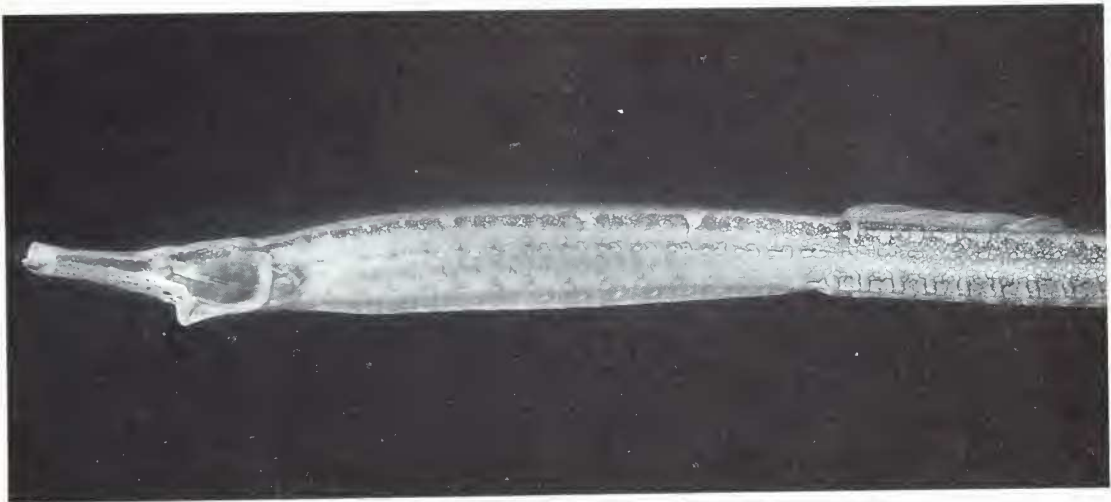
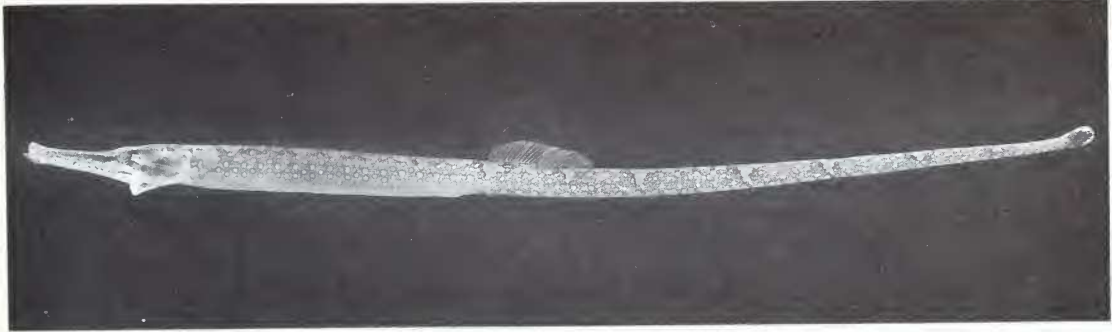
Bay, Vic.: Top—adult female, 175 mm SL (AMS I.19921-007). Middle—adult male, 145.5 mm SL (GCRL 17357). Bottom—*M. meraculus*. WAM P.25598 (adult female, 184 mm SL), East Flinders Bay, W.A.

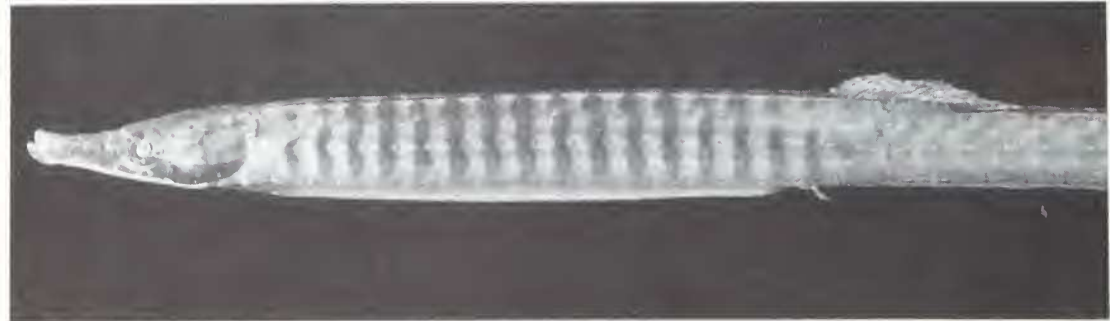
PLATE 8

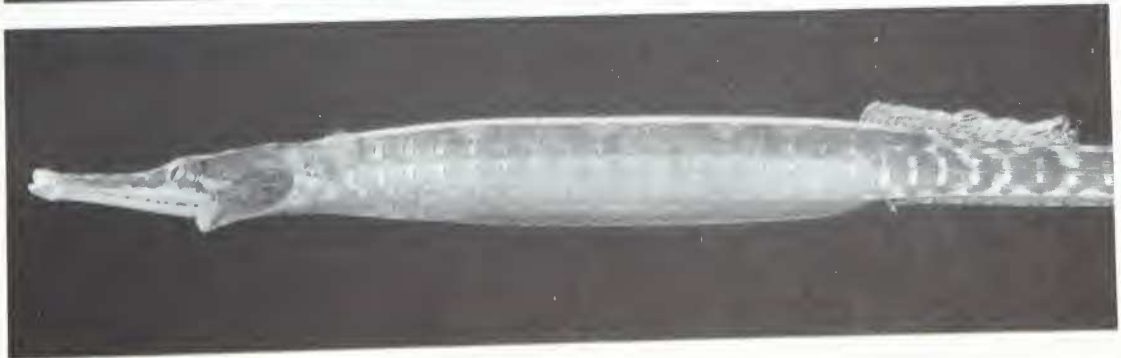
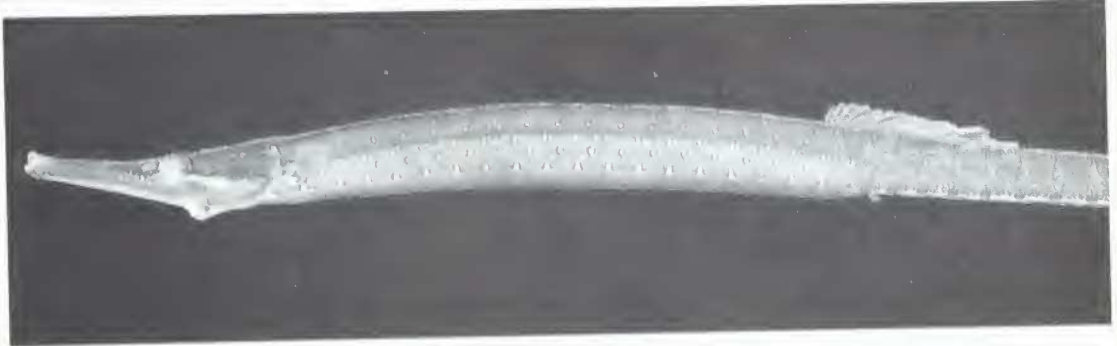
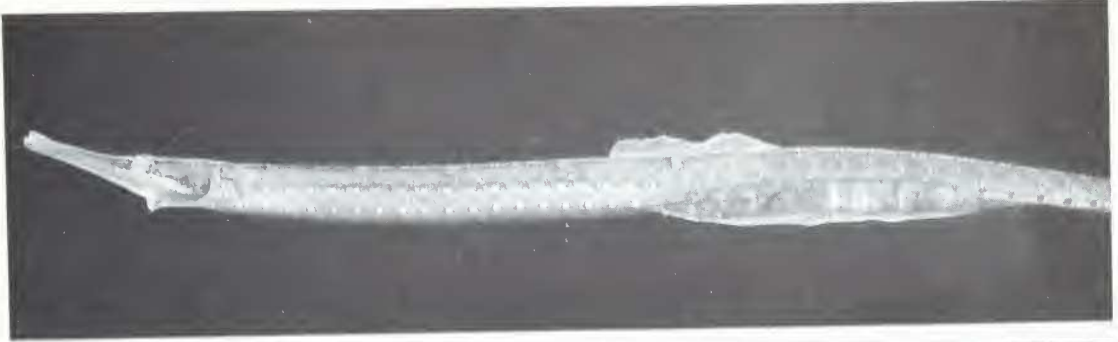
Histiogamphelus briggsii; Sydney, N.S.W. Top to bottom: Adult female (188 mm SL), adult female (184 mm SL), adult male (135 mm SL)—all CGRL 16338, and juvenile (36 mm SL), AMS I.18744-001.

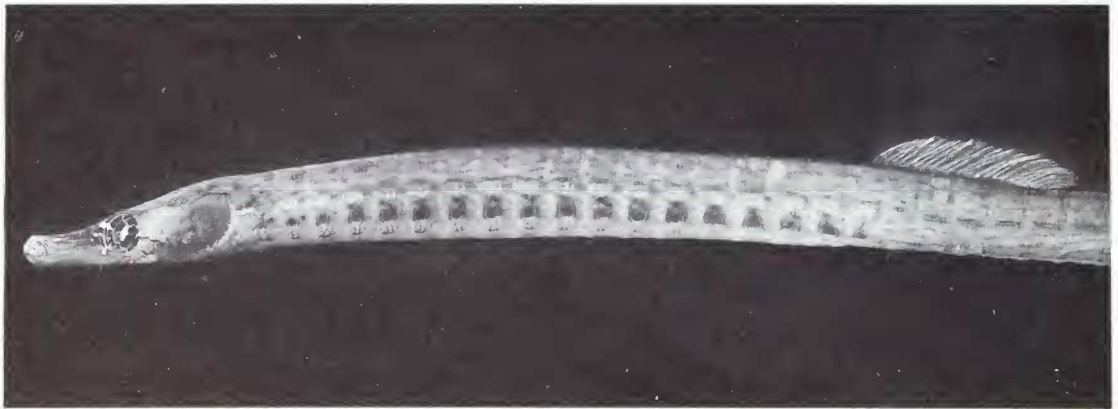
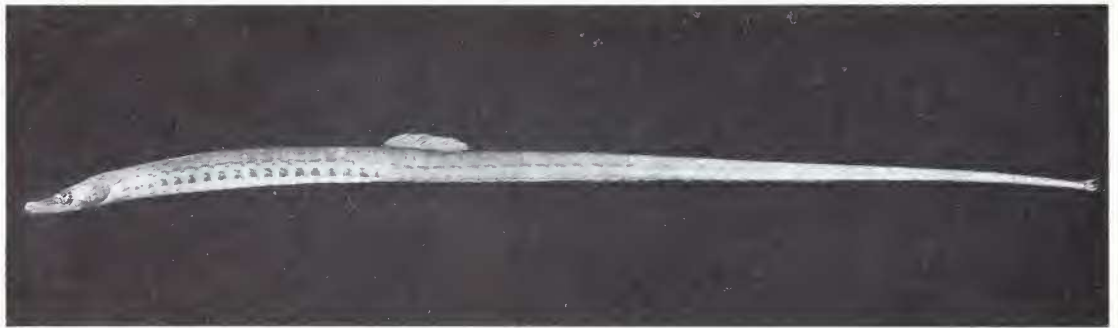
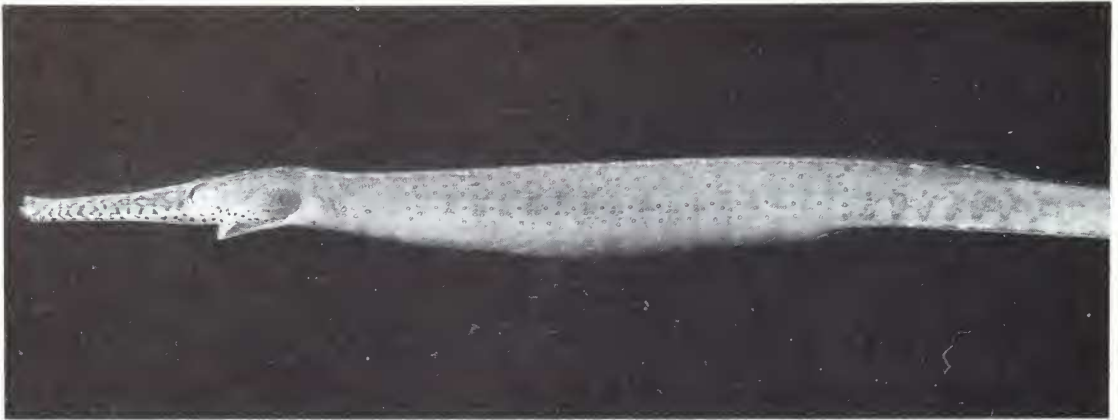
PLATE 9

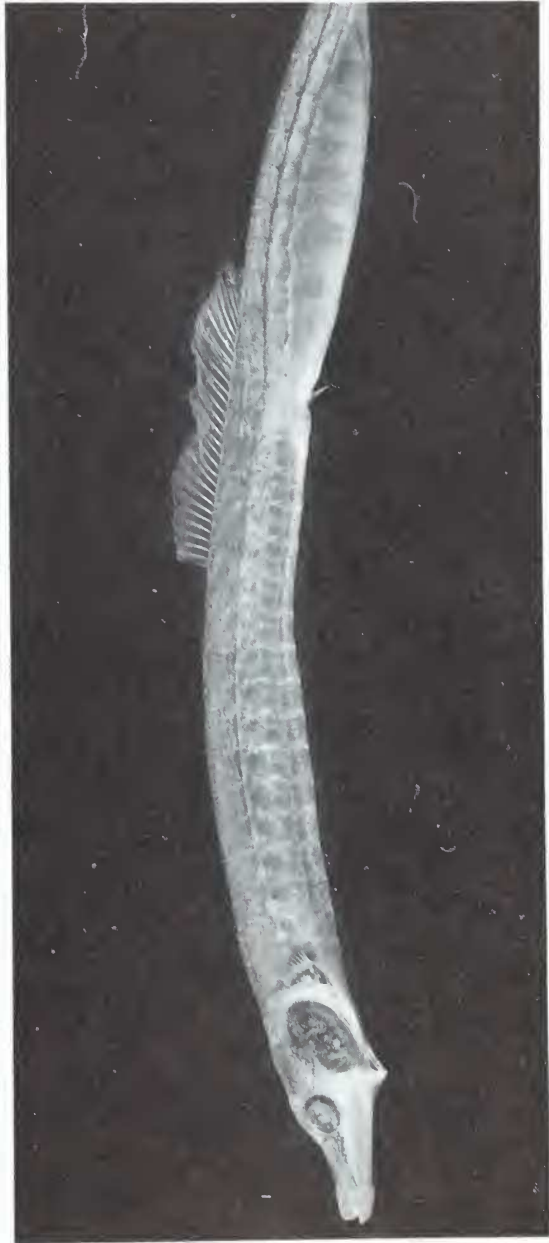
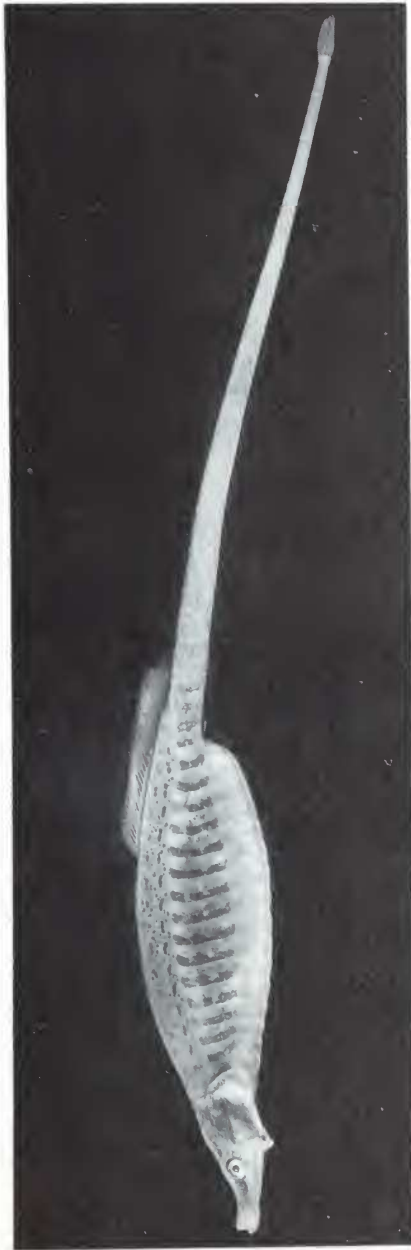
Histiogamphelus cristatus. Top to bottom: WAM P.21008-018 (adult male, 133 mm SL), Geographe Bay, W.A.; AMS I.21008-018 (immature male, 158 mm SL), Kangaroo I., S.A.: WAM P.21062 (adult female, 161 mm SL), Geographe Bay, W.A.: WAM P.25767-004 (juvenile, 39 mm SL), Recherche Archipelago, W.A.











MUMMIFIED VICTROL PLATE 6

